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On the cover: Astronaut Jerry Ross, N5SCW, works to prepare the International Space Station for its first full-time crew. Crew interviews on page 52.

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CQ Amateur Radio

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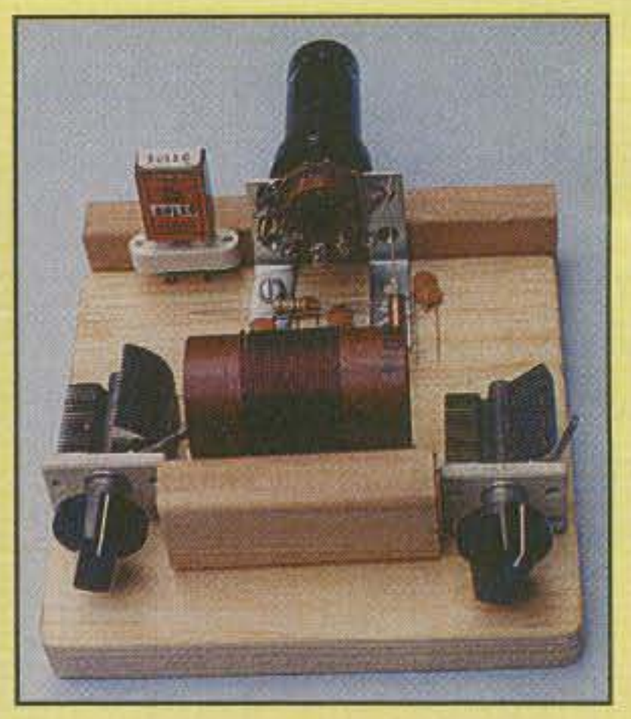

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Ham Radio News

From The CQ Newsroom

Two Arrests for Unlicensed Operation

When FCC Special Counsel for Amateur Radio Riley Hollingsworth, K4ZDH, talks to ham groups about the "reinvention" of FCC enforcement activities, he nearly always explains that increased amateur enforcement is part of a Commission-wide effort to bring its enforcement activities the same level of respect as that accorded to other federal agencies, such as the Federal Trade Commission or the Securities and Exchange Commission. He also says that ham radio is a sort of "poster child" for these efforts, since so many hams work in other FCC-regulated services and word will spread from those hams that when the FCC issues a citation, it means business. There was new proof of that mission over the summer, with the arrest of two men at different ends of the country for unlicensed operation on amateur frequencies.

William Flippo of Jupiter, Florida was arrested by U.S. Marshals on July 20 and charged by the U.S. Attorney's Office with four counts of unlicensed operation and four counts of interference with licensed stations. The marshals also seized his radio equipment. If convicted, Flippo could be sentenced to one year in prison and fined $10,000 for each count. The FCC says it had previously warned Flippo to stop transmitting illegally, and had even imposed a $20,000 fine, which Flippo apparently did not pay. According to the FCC, Flippo continued operating on ham bands and interfering with licensed hams, prompting it to seek formal charges from the U.S. Attorney's office.

In California, former ham Richard Allen Burton, ex-WB6JAC, was arrested on August 5 after being indicted by a federal grand jury on six felony counts of violating the Communications Act of 1934. According to the FCC, Burton, who had previously served prison time for prior unlicensed operation, was operating without a license on amateur repeaters in southern California. His trial on the new charges has been set for October 3.

The ARRL Wants Your CC&R "Horror Stories"

If you have a "horror story" connected with antenna limits imposed by restrictive covenants (also known as deed restrictions or CC&Rs— Covenants, Conditions and Restrictions), the ARRL wants to hear it. As part of its effort to persuade the FCC to reconsider its denial earlier this year of a petition to extend the protections of PRB-1 to private contracts (*an effort that CQ fully supports — ed.*), the League has decided to collect as much information as possible on the effects of these restrictions on individual hams. The following is from the *ARRL Letter:*

The ARRL is inviting narratives from amateurs who now are or have been denied the opportunity to install an antenna or support structure on a dwelling they own because of CC&Rs. Narratives should relate directly to situations involving restrictive covenants and should be no longer than one page for inclusion in the CC&R database. Submittals should include name, callsign, the address at which you were denied the opportunity to put up an antenna, and the basis upon which you were denied or would expect to be denied. Participants should include a copy of the contract language that would exclude your antenna or support structure and copies of any denial letters from a homeowners' association.

Submittals should be sent to ANTENNAS, c/o Steve Mansfield, N1MZA, American Radio Relay League, 225 Main St, Newington, CT 06111. E-mail submittals are welcome to <smansfield@arrl.org> with the subject line "ANTENNAS."

CQ encourages any amateur affected by CC&Rs to participate in this effort.

No More Multiple-Choice Code Tests

The National Council of Volunteer Examiner Coordinators (NCVEC) has voted to ban multiple-choice code tests on amateur license exams, and to set consistent technical standards for code test transmissions. The NCVEC is an umbrella group representing most VECs in the United States.

Meeting in Gettysburg, Pennsylvania in July, the NCVEC decided that only fill-in-the-blank tests (with 7 correct answers out of 10 required for a passing grade) and solid copy of at least 25 consecutive characters would be permitted on code tests given by its members' VE teams after June 30, 2001, although teams could begin sooner. According to the ARRL, the group also specified that audio pitch of exam transmissions must be in the range of 700–1000 Hz, and that characters must be sent using the "Farnsworth method," with letters sent at a rate of 13–15 words per minute (wpm) with spacing between letters slowing down the overall speed to 5 wpm. Slower character speeds would be permitted only as special accommodations for people with disabilities.

The moves came in response to considerable criticism that it was too easy to guess answers on multiple-choice tests without having actually copied the code transmission, and that there was too much variation in the method and technical quality of exams.

Moving Ahead on ISS Ham Station

The ham radio equipment for the International Space Station (ISS) should be on board the orbiting station by the time you read this, if all has gone according to plan. Final approval of the equipment's space-worthiness came in late July, and it was slated to be taken to the ISS in early September by the Shuttle Atlantis, according to the *ARRL Letter.*

A second callsign for the ISS ham station has been issued, this one by Germany, DLØISS. Earlier, the Russian government had issued RZ3DZR for ARISS (Amateur Radio on the International Space Station) operation. At press time no US callsign had been issued. First operations will be from the Russian "functional cargo block" module.

The initial ham station aboard ISS will consist of 2 meter and 70 centimeter handhelds, a TNC for packet, and various accessories, according to AMSAT. A spare antenna on the space station (see this month's "Amateur Satellites" column) will be used until permanent ham antennas are installed sometime next year.

All three members of the first ISS crew, scheduled for launch this month, are licensed hams and were interviewed exclusively for *CQ* by Satellite Editor Phil Chien, KC4YER. His interview appears in this month's "Amateur Satellites" column, and their "home away from home" appears on our cover.

First Canadian QSO on 136 kHz

Operating under special authorization from the Canadian government, two hams in Ontario have made the first-ever amateur contact in Canada on 136 kHz. VA3LK and VE3OT completed the ground-breaking LF QSO on July 22 over a distance of 268 miles (431 km), according to a bulletin from the Radio Amateurs of Canada (RAC). They used "QRSS," or extremely slow-speed Morse code—at 0.4 wpm—to complete the contact. More information on Canada's LF experiment is available on the RAC website at <http://www.rac.ca/infodx.htm>.

P3D Inches Toward Launch

October 31 is the latest provisional launch date for AMSAT's Phase 3D satellite, according to an announcement at the AMSAT-UK Colloquium held in July at the

(Continued on page 75)

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Zero Bias

BY RICH MOSESON, W2VU

An Editorial

Looking at "Gain" Through Cesium Glasses

For the past two months, in our "Ham Radio News" column we've been following a story that has received amazingly little attention in the general news media: A group of scientists in New Jersey apparently has managed to accelerate the speed of light. We will look at it here in some detail because of its general importance and because light waves are nothing more than very, very high-frequency radio waves.

Details of the experiment, in which a light pulse transmitted through a tube of cesium appeared to leave the tube before it finished entering it, are published in the journal *Nature* in an article entitled, "Gain-Assisted Superluminal Light Propagation," by L. J. Wang, A. Kuzmich and A. Dogariu (full text is available on the web at <http://www.nature.com> and I recommend that you read it).

Note the familiar word "gain" in the title and keep it in mind as I try to explain their explanation. First of all, their explanation for the "counterintuitive" result is that light energy from the leading edge of the laser pulse was transferred to the cesium atoms, causing *them* to emit a *new* and amplified pulse of light which leaves the chamber before the original pulse has finished entering it. The energy from the tail of the original pulse is absorbed by the cesium atoms to return them to a neutral state, so no more energy is released than absorbed.

Next, if you've ever operated a repeater in an urban setting with lots of buildings around, you've probably experienced a phenomenon called "multipath," in which succeeding radio waves bounce off buildings and arrive at your radio at the same time as waves that haven't bounced off buildings. If the waves are out of phase with each other, they cancel out and the signal drops out; if the waves are in phase, they become amplified and the signal gets louder. The result in your FM rig is a "picket fence" signal that goes up and down.

Now imagine that you're combining light waves instead of radio waves (keeping in mind that there's no difference between them except for frequency), and let's look only at those waves that are in phase and exhibit gain. What happened here, the scientists say, is that instead of the signal getting louder (or brighter, in the case of light), it got *faster*. Thus, instead of traveling *farther*, as happens with a gain-assisted radio signal, it traveled *faster*. When a beam of light goes faster, it exceeds the natural speed of light in a vacuum of 300,000 meters/second (or 186,000 miles/second). In this case, they said, it traveled more than 300 times faster!

Violating the Laws of Physics?

Several of you responded to our news stories with comments to the effect that "this can't be possible"; "Einstein says you can't exceed the speed of light"; and "you can't violate the laws of physics." True, but as we learn more, our views of the laws of physics may have to change. In order to accept Einstein's theories, it was necessary to change our view of the laws of physics as previously advanced by James Clerk Maxwell; likewise, Maxwell's theories required revisions of our understanding based on Newton's laws.

Besides—and this is a fine distinction, but science is built on fine distinctions—we're not talking here about *exceeding* the speed of light, but rather *increasing* the speed of light. Perhaps nothing other than light can go faster than light, but these scientists aren't making such a claim. They're claiming to have made light itself go faster. In fact, this is one of their basic arguments; it's been proven previously, they say, that it's possible to slow the speed of light. If, therefore, the speed of light is not static, why shouldn't it be possible to accelerate it as well? The authors also insist that while their results are "counterintuitive," they are not at odds with either the principle of causality (events are the result of a cause or causes, which must therefore precede the event) or Einstein's theory of special relativity, but are "a consequence of the wave nature of light" (see above). If you want to go much deeper into their explanation, you'll have to read their paper (which I strongly recommend) and understand a fair amount of math and physics. For now, however, let's look at some things that are already known about the behavior of light and other electromagnetic waves (such as radio waves).

The findings by Wang and his colleagues are not the first in the field to be "counterintuitive." Stephen Hawking (one of the world's few physicists who knows how to write in plain English so that physics can be more understandable to the typical educated person), in his classic book *A Brief History of Time*, talks about the "two-slit experiment." Light is projected through two slits onto a screen, and the resultant pattern of light and dark "fringes" occurs because the light waves passing through the two slits to the same spot on the screen are traveling different distances and are therefore out of phase. This means that some waves cancel each other out while others reinforce each other (the light version of "multipath"). If there's only one slit, Hawking writes, there are no fringes. The same results occur if you replace the light with a stream of electrons of a known wavelength. Here's where it gets counterintuitive, as Hawking explains:

"If electrons are sent through the slits one at a time, one would expect each to pass through one slit or the other, and so behave just as if the slit it passed through were the only one there—giving a uniform distribution on the screen. In reality, however, when the electrons are sent one at a time, the fringes still appear. Each electron, therefore, must be passing through *both* slits at the same time!"

Conclusion: It is possible, at least at a subatomic level, to be in two places at one time (just don't tell your wife; of course, she'll probably tell *you* that women have *always* known that).

Next, hams who operate at microwave frequencies have learned that various forms of "scatter" (a term that should be familiar to DXers on any wavelength) permit long-distance propagation. They also will tell you that scattering at microwave frequencies results not from reflection or refraction, but from *illuminating* the scattering medium, which in turn *re-radiates* the energy (see Williams, "10 GHz—A Good Band for a Rainy Day," *CQ VHF*, February 1997, pp. 20–25; or Tom's website at <http:/ www.wa1mba.org>). This is essentially the same thing that's happening with the laser light in Wang, et al's experiment. The energy is absorbed and re-radiated by the scattering medium.

Now in the case of random scattering media, such as rain droplets or air molecules, the re-radiated signals may be "scattered" in all directions. It's well known, though, that cesium atoms in a tube will align themselves with each other and change state at a predictable rate when excited by a signal at the proper frequency (the basis of atomic clocks). When excited by a laser pulse, which is coherent light (all of the same frequency and in phase), it certainly would be logical to conclude that the all-lined-up cesium atoms could in turn emit a pulse of equally-coherent light. Wang and his associates actually used three beams simultaneously from the same laser, two continuous-wave (CW) beams with right-hand circular polarization (another term familiar to many hams, especially those active in satellite communications), and one pulsed beam—in between the other two in frequency *and at the resonant frequency of the cesium atoms*—with left-hand circular polarization. They noted that when the laser was retuned away from the cesium's F_r (frequency of resonance), the light beams traveled through it at normal speed.

Applications for Radio?

This raises fascinating questions about the nature of all electromagnetic energy, including RF, transmitted through a fluid (including air). What are the implications for electromagnetic waves at other frequencies? Other elements besides cesium? Do radio waves in a "fluid" (any liquid or gas, including air) actually move at all? Or is terrestrial radio propagation actually accomplished by successive waves of molecules receiving and re-radiating energy that originates in our transmitters and is transferred into the propagation medium (air) by our antennas? Were early theories about the "ether" as a medium of radio transmission not really so far-fetched? Just as "radio" is once again "wireless," is it time for a new high-tech examination of the "ether"?

Let's go back to that magic word in the title of Wang's paper—*gain*. We hams know a lot about gain. We constantly work on improving our antennas, hoping to squeeze out every last bit of gain. Of course when we talk about gain, we're talking about increasing the *distance* our electromagnetic waves will travel. When Wang's group talked about gain, they were talking about increasing the *speed* at which their electromagnetic waves would travel. Anyone

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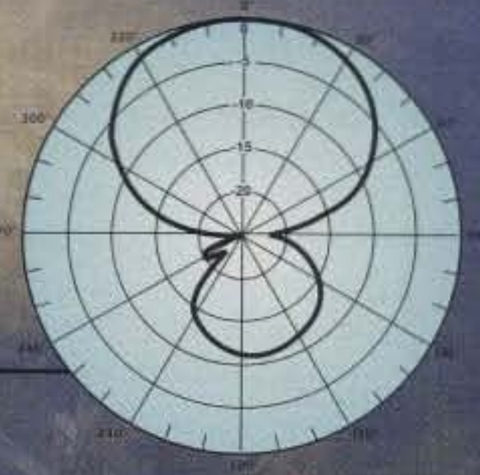

MA5B SPECIFICATIONS						
FREQUENCY	10	12	15	17	20	Meters
ELEMENTS	2	1	2	1	2	per band
GAIN	5.3	1.0	4.8	1.0	3.6	dBi
FRONT TO BACK RATIO	10	0	12	0	22	dB
SIDELOBE ATTENUATION	25	25	25	25	25	dB
VSWR 2:1 BANDWIDTH	665	>110	255	>100	90	kHz
LONGEST ELEMENT	17.1ft (5.2m)					
TURNING RADIUS	8.8ft (2.7m)					
BOOM LENGTH	7.3ft (2.2m)					
BOOM DIAMETER	1.5in (3.8cm)					
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who has survived high school math and figured out where cars A and B would meet when heading toward each other at different speeds over a known distance understands that speed and distance are inextricably intertwined, two sides of the same equation. Over great distances they even seem to merge. A light year, for example, is a measure of distance, not of time.

Is it possible to increase the *speed* of radio waves transmitted through certain substances? As with light, we already know it's possible to slow them down; just check out the velocity factor of your favorite feedline. Whenever we experiment with antennas, we are trying to manipulate the *distance* covered by radio waves traveling at a set speed. Couldn't it be feasible to rearrange the equation and manipulate the *speed* of radio waves over a set distance? What would happen if we did? Could transmission delays in satellite and EME (Earth-Moon-Earth) contacts be reduced or eliminated?

We are hams, not physicists (although some of us are both), and we may not have at our disposal all the fancy tools of modern physics. However, we do have devices that emit electromagnetic waves of known frequency and wavelength, sensitive detectors of waves emitted elsewhere, and enough knowledge of RF propagation that we can at least start to ask the right questions. And while I don't have anything near the scientific knowledge to investigate these questions, I know that many of you do. I encourage you to do so, and to report your results here as well as in a scientific journal, if appropriate.

It's Been Done Before

I also encourage you to remember Grote Reber, ex-W9GFZ. He was a radio engineer living in Illinois during the Great Depression. An avid VHF/UHF experimenter (two of his first four published articles appeared in CQ's predecessor, Radio magazine), Reber was fascinated by Karl Jansky's discovery in 1932 of radio waves coming from the center of the Milky Way galaxy. Looking for new challenges, Reber built a 32 foot parabolic dish in his back yard in 1937 and started listening to the stars. He made the first map of the "radio sky" and is today recognized as the father of radio astronomy. No longer an active ham, Greber lives in Tasmania, where he continues his studies in radio astronomy. His original radiotelescope is on display at the National Radio Astronomy Observatory in Green Bank, West Virginia, and the NRAO Amateur Radio Club has Reber's old callsign, W9GFZ, in his honor.

The NRAO website has a page entitled "Early Radio Astronomy: The Ham Radio Connection," written by Dave Finley, N1IRZ, from which much of the above information came. It includes the following: "...the accidental discovery of cosmic radio emissions was a direct result of radio amateurs' success in developing shortwave communications. Then, for several years after this original discovery, the only person following up with systematic and well-designed radio astronomy observations was a radio amateur."

QSY to Infrared

Before we leave the topic of light and associated frequencies, there are now available on the World Wide Web nearly two million images from an infrared sky survey sponsored by NASA and the National Science Foundation. Officials say the Two-Micron All Sky Survey (2MASS) is the most thorough census of stars ever made. Infrared frequencies were used because signals at these wavelengths pass through gas and dust in our galaxy better than visible light. For details, see <http://science.nasa.gov/headlines/y2000/ast20jul_1.htm>. To view images from the sky survey, check out <http://www.ipac.caltech.edu/2mass/> and <http://pegasus.astro.umass.edu/GradProg/2mass.html>.

Most of us think of infrared in terms of very short-range signals, such as from our TV remotes to the set, or in public restrooms, for that matter. Astronomers think of infrared in terms of exceedingly long-range signals. It's time for hams to start thinking about infrared in terms of a viable communications medium. Remember, our amateur licenses grant us the authority to experiment and operate on all frequencies above 300 GHz. But most important, it's time for hams to start thinking "outside the box" and to reclaim our mantle as leaders in the development of radio technology. We have an opportunity today similar to that which Grote Reber had in the 1930s—using our skills, equipment, and curiosity to explore whole new areas of radio science. It is an opportunity that we must embrace.

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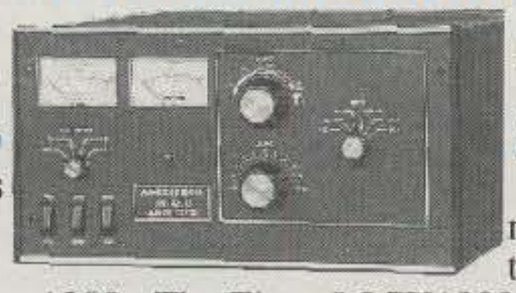

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CIRCLE 127 ON READER SERVICE CARD

Announcements

The following Special Events are scheduled for October:

Worked Chenango County (NY) Award – The Chenango Valley ARA is sponsoring the Worked Chenango County, New York Award. Work two Chenango County stations from 1200Z October 14 to 2359Z October 15 on 10, 15, 20, 40, 80 meters to earn the certificate. QSL to Tony Masi, N2GUB, 3289 State Highway 206, Bainbridge, NY 13733-3114.

K2BR, from Miss America Pageant, Atlantic City, New Jersey; Southern Counties ARA; 1400Z Oct. 9 to 0400Z Oct. 15 on SSB 28.325, 21.325, 14.250, 7.250; CW 28.030, 21.050, 14.050, 7.050. QSL to SCARA, P.O. Box 121, Linwood, NJ 08221.

W2CVT, from S. F. B. Morse Home, Poughkeepsie, New York; Poughkeepsie ARC; 1400–2000Z Oct. 14 & 15; two stations operating on 7.120, 14.035, 14.235, 21.120, 21.310, 28.120, 28.350 (±10 kHz QRM). For QSL and certificate send QSL and #10 SASE to W2PTF, 3 Little Road, Wappingers Falls, NY 12590.

W2R & N2R, from 30th anniversary of Harris RF Communications ARC, 40th of RF Comm.; Rochester, New York; 1600Z Oct. 13 to 2000Z Oct. 15 on 7.050, 7.240, 14.040, 14.240; For certificate or QSL send QSL and SASE to Harris RF Comm. ARC, Att: J. Bremer, 1680 University Ave., Rochester, NY 14610-1839.

3-land, Susquehanna Valley ARC from Bison Foliage Days, Richfield, Pennsylvania; 1600–2300Z Oct. 7 & 8 on 7.25 and 3.85 (also some PSK32). For certificate QSL to Chris Snyder, NG3F, RR #1 Box 92, Richfield, PA 17086 (<ng3f@arrl.net>).

K3G, from 61st anniversary of US Coast Guard Auxiliary, Coast Guard Base Group Philadelphia, Pennsylvania; 1400–0000Z Oct. 21 on 7.232, 14.332, 21.332, 28.332. QSL to Dan Amoroso, NM3S, 196 Dam View Drive, Media, PA 19063 (<nm3s@prodigy.net>).

KE4ZXW, from four year anniversary of 9600 baud automatic satellite operation and the Amateur Radio Exhibit; Virginia Air & Space Center, Hampton, Virginia; VASC Amateur Radio Group; Sept. 30 and Oct. 1 0000–2400Z on UO-22 or KO-25, 1500–2200Z @ :00 on 7.265, @ :15 on 14.265, and @ :30 on 28.365. For QSL send SASE to Ed Brummer, W4RTZ, 108 Oyster Cove Road, Yorktown, VA 23692.

W5M, from Maplewood planned community, Louisiana; Southwest Louisiana Amateur Repeater Club; 1300–2100Z Oct. 14 on 7.245, 14.245, 21.335. Request QSL or certificate: SWLARC, P.O. Box 7244, Lake Charles, LA 70606 (KA5SUR, <navycb@structurex.net>).

WØFUN, from Nowhere, Illinois; 1500–2000Z Oct. 21 on 7.234 and 14.243 MHz. For certificate send SASE to Iowa Radiosport Society, P.O. Box 73, Denmark, IA 52624-0073.

The following hamfests, etc., are slated for October:

Oct. 2, **Red Rose Repeater Assn. Tailgate Fest**, West Earl Community Park, Lancaster County, Pennsylvania. Contact Dave, W3CWE, <jjcd@prodigy.net>. Talk-in 147.015, PL 118.8.

Oct. 4–5, **West Texas ARC 2000 Hamfest**, Ector County Coliseum, Odessa, Texas. Contact Craig Martindale, W5BU, 1719 Rosewood, Odessa, TX 79761 (915-366-4521; <w5bu@hotmail.com>). (Exams)

Oct. 8, **LCDRA & CMARC Hamfair**, The Summit, Dimondale, Michigan. Contact J. Ervin Bates, W8ERV, P.O. Box 80106, Lansing, MI 48908 (517-676-2710; <w8erv@arrl.net>). Talk-in 145.390- & 146.520. (Exams)

Oct. 8, **Nutmeg Hamfest, Computer Show, & ARRL State Connecticut Convention**, "Mountainside Special Event Facility," Wallingford, Connecticut. Contact Gordon Barker, K1BIY, 9 Edge Wood Rd., Portland, CT 06480 (860-342-3258). (Exams, info Paul Lux, K1PL, 860-635-1742)

Oct. 13–15, **US Air Force MARS Region One Conference**, Lenox Inn, Reynoldsburg, Ohio. Contact Jerry Lowery, AFA1XZ, 2142 Belltree Dr., Reynoldsburg, OH 43068-3506 (614-866-8341).

Oct. 14, **North Kitsap ARC Hamfest**, Kitsap County Fairgrounds, Bremerton, Washington. Contact Marcie Stilwell, KC7DAT, P.O. Box 2268, Silverdale, WA 98383-2268 (360-697-2797, e-mail: <nkarc@yahoo.com>, <www.silverlinkg.net/nkarc>).

Oct. 14, **Egypt Temple ARA Ham/Computerfest 2000**, Egypt Temple Complex, Tampa, Florida. Contact Jay Strom, 727-822-9107, <k9bsl@juno.com>. Talk-in 146.940. (Exams 1300Z)

Oct. 14, **Garden State 2K Hamfest**, Croydon Hall, Leonardo, New Jersey. Contact Mario Sellitti, P.O. Box 286, Keansburg, NJ 07734 <http://www.monmouth.com/~gsara>. Talk-in 145.485 -6, 151.4. (Exams 10:30 AM)

Oct. 15, **Lima Hamfest & Computer, Radio Control Aircraft Show**, Allen County Fairgrounds, Lima, Ohio. Contact Gregg Swark, <gas1950@aol.com>, or P.O. Box 211, Lima, OH 45802.

Oct. 15, **Kalamazoo Hamfest**, Kalamazoo County Fairgrounds, Kalamazoo, Michigan. Contact Charlie Burgstahler, 6658 Carlisle Drive, Kalamazoo, MI 49009 (<charlieb@net-link.net>, <www.qsl.net/ka8blo/hamfest.html>).

Oct. 15, **Hall of Science ARC Hamfest**, NY Hall of Science parking lot, Flushing Meadow Corona Park, Queens, New York. Contact Stephen Greenbaum, WB2KDG, 718-898-5599 (evenings only), <wb2kdg@bigfoot.com>. Talk-in 444.200, PL 136.5, 146.52 simplex. (Exams 10 AM, info W2LJM 718-323-3464, <lmenna6568@aol.com>)

Oct. 20–22, **Pacificon 2000 Hamfest**, Sheraton Hotel, Concord, California. Contact Pacificon 2000, P.O B. 272613, Concord, CA 94527 (925-932-6125; <paccon00@pacbell.net>, <http://www.pacificon.org>). (Exams)

Oct. 21, **Mid-Valley ARES Swap-Toberfest, ARES Convention**, Polk County Fairgrounds, Rickreall, Oregon. Contact Bud Smith, WA7FJF, 503-838-0266, e-mail: <wa7fjf@arrl.net>, <http://www.teleport.com/~n7ifj/swaptobe.htm>. Talk-in 146.86.

Oct. 21, **SVARC Computer, Elecetronics, Amateur Radio Show**, Sunbury Armory, Sunbury, Pennsylvania. Call 570-286-2086, e-mail: <fhac@mail.com>, <http://avs.epix.net/svarc/>. Talk-in 147.270, 146.250.

(Continued on page 97)

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Lew McCoy, W1ICP, Silent Key

BY RICH MOSESON, W2VU
Editor, *CQ*

Lew McCoy, W1ICP, a "living legend" in ham radio and a fixture on the *CQ* masthead since 1981, became a Silent Key on July 31 at age 84. Known widely as "Mac," Lew was an ARRL staffer for over 30 years, and after his retirement, joined *CQ* in 1981 as Technical Representative. In his lifetime he wrote hundreds of ham radio articles and one book, *Lew McCoy on Antennas*, published by *CQ*. Antennas were a perennial favorite of Mac's, and in fact, he was working on several reviews of antennas and antenna accessories at the time of his death.

I met Mac the first time I went to Dayton with *CQ*, in 1992, and I looked forward to those annual visits. My favorite memories of Lew are his "holding court" at the *CQ* booth as a succession of visitors came by to chat, and of sitting with him back at the hotel at the end of the day, listening to his stories of people and events collected over a half century in ham radio.

Many of those years were spent as an ARRL staffer, so I guess it was only natural for the folks at the League to concentrate on that part of Lew's career when writing their obituary. However, he left the League over 20 years ago, and continued to play a very active role as a leader in amateur radio until just before his death. We'll start our look at Mac's contributions to ham radio by quoting from the August 1981 issue of *CQ*, in which Editor Alan Dorhoffer, K2EEK, introduced him to our readers:

Lew McCoy, W1ICP, SK July 31, 2000.

> In the early 1950s, when I began my interest in amateur radio, I used to read *QST* and *CQ* each and every month, and some of my favorite articles were written by Lew McCoy, W1ICP. He was one of my early heroes in amateur radio as a Novice, and I guess that over the years, I've built just about everything he's described.
>
> I first met Lew, although to many he is known as Mac, when I began working for *CQ* in 1961. I began going to hamfests and conventions where I would see Lew enthrall audiences with his talks, and it was exciting just to meet and talk to him. Lew is "on" all of the time. He never talks down to someone and will spend an infinite amount of time with anyone with a question just to make sure he or she understands. He's been sort of the Pied Piper of amateur radio, instilling an enthusiasm in everyone who has met him or read his work. He is literally a living legend....
>
> The following biography outlines his history in amateur radio and his tenure at the ARRL. We are especially proud that he has joined our staff....
>
> Lew McCoy, W1ICP, was first licensed in 1946 with the call W9FHZ (in Chicago). Lew got his interest in amateur radio from his father, who was an early spark experimenter. W1ICP went to work for the League in 1949, retiring from there on July 1 of this year. During his 30 years at the ARRL, he was employed in many capacities. His first job was Asstistant Communications Manager. His most notable accomplishment in that position was being the originator of the 10-meter W.A.S. (Worked All States) Contest and the Novice Roundup. In 1951, he moved over to the Technical Department as a Technical Assistant, working under technical greats such as George Grammar, Byron Goodman, and Don Mix. In the early '50s, Lew traveled the then 48 states lecturing on TVI and demonstrating the methods for curing the problems. About that time, the Novice license was created by the FCC, and Lew wrote an article for the newcomer every month, rolling up an impressive number of articles over the years. He is the originator of circuits such as the ultimate, or universal ,transmatch and the monimatch. Versions of both circuits can be found in nearly every ham shack in the world.
>
> Lew did extensive traveling and lecturing over the years and completed his later years as FM Editor, which entailed considerable FCC contact work. He retired as Senior Assistant Technical Editor, and now lives in Silver City, New Mexico.

After his retirement from the League, Lew continued his writing and speaking as *CQ*'s Technical Representative. And while he didn't have a monthly column (he was *retired*, after all!), his articles and reviews appeared regularly, and he wrote his first and only book, *Lew McCoy on Antennas*, as part of his never-ending effort to help demysitify ham radio technology and to explain often-complex topics in easy-to-understand terms. This was a lifelong goal, as noted in the ARRL obit on Lew, quoting retired ARRL Communications Manager George Hart, W1NJM, who said, "He became a hero of all the Novices and beginners because his stuff was so down-to-earth and easy to read."

Lew also became very active in the Quarter Century Wireless Association after his retirement from the ARRL, being elected to the QCWA Board of Directors in 1983, and serving in a variety of leadership positions there, including President (1994–1996). He was a proponent of the no-code Technician license (a concept proposed to the FCC by QCWA) and of reducing the maximum code test speed for all license classes to 5 words per minute. According to QCWA General Manager Jim Walsh, W7LVN, Lew remained active on the organization's board as Past President and continued to be a featured speaker at many QCWA conventions and hamfests around the country. "He always represented QCWA wherever he might be," Walsh added. In a somewhat ironic twist, Mac had just been re-elected to the QCWA board, but became a Silent Key before being able to be told about it.

Lew McCoy is survived by his wife, Clara Gibbs McCoy (Lew's first wife, Martha, died in 1998 after more than 50 years of marriage); by his daughters, Marsha Ashurst, W1HAQ, and Sharon Armann (ex-WN1GQR); and by grandchildren and great-grandchildren. The family is planning a memorial service for Lew in December, and requests that anyone wishing to make a memorial contribution in his name direct it to Hospice of the Valley, 1510 E. Flower Street, Phoenix, AZ, 85014-5656. Condolences and personal remembrances to Lew's family may be sent via Marsha Ashurst, P.O. Box 2260, Lakeside, AZ 85929.■

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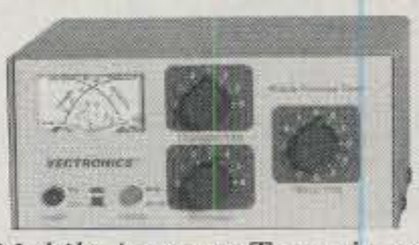

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- Cell blocked in USA
- 1000 memory channels
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50/2M/440HT
- Wideband RX
- 6M-2M-440TX
- 5W output
- 220 mems, opt. barometer unit
- Alpha Numeric Display
- CTCSS/DCS built-in
- Li-Ion Battery

$20. mfg coupon — exp. 10/31/00

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VX-1R
2M/440 Sub-Mini HT
- 290 Memory Channels
- .5W output
- Receives 76-999mHz plus AM BCB (Cell Band Blocked)
- Lithium Ion Battery

Call For Your Low Price!

FT-50RD
2M/440mHz Compact HT
- DVR, Decode, Paging Built-in
- Alpha numeric display
- Wide Band receive
- Battery Saver
- 112 Memories
- Mil-Spec
- HiSpeed scanning

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FT-847
Ultimate Base Station, HF, VHF, UHF
- 100w HF/6M, 50w 2M/430 mHz
- DSP • Full Duplex Cross-band
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FT-90R
2M/440 Mini Dualbander Transceiver
- 50w 2m, 40w 440mHz
- Wide Rx • Detachable Front Panel
- Packet Ready 1200/9600 Baud
- Built-in CTCSS/DCS Encoder/Decoder
- Less than 4" wide!

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- 100w 160-6M, 12VDC
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- Computer controllable, CAT System

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Results of the 1999 CQ WW DX CW Contest

BY BOB COX,* K3EST

What do you call out-of-this-world conditions, jam-packed CW bands, and 3550 logs? The Godzilla of contests: the 1999 CQ WW CW. Conditions were so good that there was activity on 10 meters clear into the beacon part of the band. There was something for everyone. The low bands were good. The high bands were excellent. One entrant commented that he was very surprised that he worked DXCC, WAZ, WAE, and he thinks WAS in one weekend! Whether you were a casual entrant or a Formula 1 contester, you came to appreciate just what is possible in a DX contest. Mark your calendars this year to join in the 2000 CQ WW. You won't regret it. You will experience what so many men and women contesters have come to learn: Contesting is fun and personally challenging. Below are presented many of the highlights of the 1999 CQ WW CW Contest. Read on to learn more and see how you did.

The VE3EJ multi-single team (left to right): VE3XN, VE7ZO, VA3UZ, and VE3EJ.

All Band

"As good as it gets" might be the motto of the top contestants for this year's coveted high power, all band crown. It takes a lot of thought, work, and band-wise intelligence to challenge for top honors. With conditions so good the battle was met. The Top Ten World score box contains some of the best operators who have ever pushed a key. This time the crown came to rest on the head of Trey, N5KO, who pushed his station, HC8N, and himself to new heights—a new world record. The station at HC8N was born from nothing a few years ago and has since moved itself into high contention. Trey had 7001 QSOs! That's a lot of Qs, in case you were wondering. In second place in the world was Jose, CT1BOH, operating from P4ØE. Jose is a real competitor who thinks about the contest from every angle. In third place was Ville, OH2MM, operating from EA8EA. Ville took time off from his university chores to put EA8 in a lot of logs.

Doesn't a 1-land station always win the USA top position? Wrong! In 1999 Bill, W4AN, keyed his way to a new USA CW record and first place. All his work to make his station very competitive sure paid off big time. In second place (It seems strange to write those words.) was John, K1AR. Both W4AN and K1AR broke the old record. Third-place USA went to the fine performance by Greg, W1KM.

Europe produced some surprises. The first-place spot was won by Dan, LY1DS, operating from LY6M. Conditions were so good that they took away the advantage of stations much farther to the west. Second place went to Andrew, GIØNWG, operating at GIØKOW. Third and fourth place were very close. They were taken by OHØZ, operated by OH7JT, and Boris, S58A, respectively.

Mention must be made of W4AN's finish within the top ten world scores—a tough feat. The jobs done by A45XR, E4/S53R, JH4UYB (a new Japanese record), and XU7AAV were outstanding.

Low Power

Running only a 100 watts forces a serious contester to adapt his or her strategy to rapidly changing conditions. Should I run or should I search & pounce? The low power category is the most popular in the contest. If you can make it into the TopTen box you can be rightly proud of your accomplishment. This year's Top Ten box has members from five continents. Heading the list is FG5BG. This station was keyed to the top spot by Mike, K9NW. A FB job, Mike. Not far away was the second place world winner, Felipe, NP4Z. Just behind Felipe was Jaroslav, SU9ZZ. He gave many people that rare double multiplier. Taking time off from diving in the beautiful waters of the Solomons was fourth place winner Paul, K1XM, at H44MX.

Finishing #1 in the USA and #6 in the world was Brooke, N2BA. Just behind Brooke was Mark, K1RO. Both broke the coveted 3 million point barrier. Much farther west was the station of KØEJ/4, who finished third. Looking to the far west USA, you will find K6XV as the top score, followed by K7ZA and K6RO.

The top European honor goes to Ulrich, DL2HBX, who pushed DAØFF to new heights and was just short of a new European record. In second place was Franc, S59AA. Over the years Franc must be the European low power station who has had the most consistent high result. Only 54K separated third through fifth place. Yuri, EW2CR, took third place, followed by Con, DF4SA, and Marco, IKØYVV.

Special mention must be made of the efforts of XX9TDX (SMØGNU), CE3AA, VU2PAI, V73CW, YB2UU, EA8/DJ1OJ, and JEØUXR, who finished at the top or near it for their continents. Wonderful efforts from remote areas.

QRP

Working people with 5 watts is a challenge at any time. Doing it during the CQ WW when conditions are great and the QRM is wall to wall is a *real* challenge. This year there were many operators who took up that challenge. A top ten QRP world list would include every continent except Oceania.

Leading the way and setting a new world QRP all band record was John, W2GD, operating from P4ØW. The real battle was for the other nine positions. In second place was Vitas, LY2FE, who had the top European score. He was followed closely by Bob at VE3KZ, the

*1816 Poplar Lane, Davis, CA 95616
e-mail: <questions@cqww.com>

TROPHY WINNERS AND DONORS CW

SINGLE OPERATOR
All Band
World
HC8N (Opr. Robert Garlough, N5KO)
Donor: Albert Kahn, K4FW – W9IOP Memorial

World Low Power
FG5BG (Opr. Mike Tessmer, K9NW)
Donor: Slovenia Contest Club

World QRPp
P4ØW (Opr. John Crovelli, W2GD)
Donor: Gene Walsh, N2AA

World Single Operator Assisted
OT9T (Opr. John Devoldere, ON4UN)
Donor: Snake River Contest Club

U.S.A
Bill Fisher, W4AN
Donor: Frankford Radio Club

U.S.A. Low Power
Brooke Allen, N2BA
Donor: North Coast Contesters

U.S.A. – Zone 3
W6EEN (Opr. Kenneth S. Widelitz, K6LA)
Donor: Bill Fisher, W4AN

U.S.A. – Zone 4
W9RE (Opr. Patrick Barkey, N9RV)
Donor: Bill Fisher, W4AN

Canada
VE2IM (Opr. Yuri Onipko, VA3UZ)
Donor: Jim Fisher, VE1JF

Caribbean/C.A.
VP5GN (Opr. David K. McCarty, K5GN)
Donor: Chuck Shinn, W7MAP

Europe
LY6M (Opr. Dainius Savicius, LY1DS)
Donor: Edward Bissell, W3AU

Europe – Low Power
DA0FF (Opr. Ulrich Ann, DL2HBX)
Donor: Scott Jones, N3RA & Tim Duffy, K3LR

Africa
EA8EA (Opr. Ville Hiilesmaa, OH2MM)
Donor: Gordon Marshall, W6RR

Asia
Chris Dabrowski, A45XR
Donor: Chuck Shinn, W7MAP

Japan
Masaki Okano, JH4UYB
Donor: Japan Crazy Contesters Club

Japan – Low Power
Masataka Kamata, JEØUXR
Donor: Western Washington DX Club

Oceania
9M6NA (Opr. Saty Nakamura, JE1JKL)
Donor: Peahi Contest Club

South America
P4ØE (Opr. José Carlos Cardoso Nunes, CT1BOH)
Donor: Venezuela DX Club

Single Operator, Single Band
World – 28 MHz
ZX5J (Opr. James Neiger, N6TJ)
Donor: Joel Chalmers, KG6DX

World – 21 MHz
5NØW (Opr. David Klimosz, OK1RK)
Donor: N5JJ Memorial (Don Busick, K5AAD)

World – 14 MHz
Kazimierz Drzewiecki, SP2FAX
Donor: W2JT Memorial (North Jersey DX Assn.)

World – 7 MHz
Jiri Pesta, OK1RF
Donor: Alex M. Kasevich, VP2MM

World – 3.5 MHz
VC1A (Opr.Yuri Blanarovich, K3BU)
Donor: Fred Capossela, K6SSS

World – 1.8 MHz
C4A (Opr. Ivo Pezer, 9A3A/5B4ADA)
Donor: Kenneth Byers, Jr., K4TEA

USA – 28 MHz
Vincent Sgroi, K1RM
Donor: Wireless Institute of the Northeast-Treasury

USA – 21 MHz
Scott Detloff, K8DX
Donor: Wayne Carroll, W4MPY

USA – 14 MHz
K9XD (Opr. Cedrick W. Johnson, K9YO)
Donor: Northern Illinois DX Association

USA – 7 MHz
Philip Allardice, KT3Y
Donor: W6AM Memorial (Jan Perkins, N6AW)

USA – 3.5 MHz
Robye L. Lahlum, W1MK
Donor: Bill Feidt, NG3K

USA – 1.8 MHz
George E. Taft, W8UVZ
Donor: Dave Patton, NT1N & Mark Obermann, AG9A

Canada (28 MHz)
Lajos Laki, VA3RU
Donor: Radio Amateurs of Canada

Carib./C.A. (28 MHz)
3E1DX (Opr. Stefan Radtke, DL5XX)
Donor: Snake River Contest Club

Europe – 28 MHz
Ron Stone, GW3YDX
Donor: John Pryor, K4OGG

Europe – 21 MHz
OH0V (Opr. Jukka Klemola, OH6LI)
Donor: Robert Naumann, N5NJ

Europe – 14 MHz
Wilfried Gottschald, DJ7AA
Donor: G3FXB Memorial (Maud Slater)

Europe – 7 MHz
Zdravko Balen, 9A9A
Donor: Ivo Pezer, 9A3A/5B4ADA

Europe – 3.5 MHz
ZB2X (Opr. Jorma S. Saloranta, OH2KI)
Donor: K3VW Memorial (Frankford Radio Club)

Europe – 1.8 MHz
SN3A (Opr. Czeslaw Dubicki, SP3HLM)
Donor: Pat Barkey, N9RV & Terry Zivney, N4TZ

Japan – 21 MHz
Kenji Koishi, JH3AIU
Donor: DX Family Foundation

Japan – 14 MHz
Hiromori Usui, JR1XFS
Donor: Mitsuhiro Nishimura, JA7WME

MULTI-OPERATOR, SINGLE TRANSMITTER
World
P3A (Oprs. RA9JX, UA3DPX, RZ9UA, RW3TJ, UA3TU, UT7QF, 5B4AGM, RZ3AS)
Donor: Anthony Susen, W3AOH

U.S.A.
K1KI (Oprs. K1KI, K1CC, KM1P, K5ZD, W1RM)
Donor: Douglas Zwiebel, KR2Q

Canada
VE3EJ (Oprs. VE3EJ, G4VXE, VA7RR, VE2ZP, VE7ZO)
Donor: Eastern Canadian DX Assn.

Carib/C.A.
8P9Z (Oprs. K4BAI, N4TO, K1TO)
Donor: Octorino G. Villa, PY2KC

Africa
S92CW (Oprs. DA1MH/KAØKKO, DK5AX/K2AXS)
Donor: Harry Booklan, RA3AUU

Asia
ZC4AKR (Oprs. 5B4AGC, 5B4AFB, G3VMW, G3ZEM, ZC4OS, ZC4CM)
Donor: Steve Merchant, K6AW

Europe
EA6IB (Oprs. EA3AIR, EA3AJW, EA3GGO, EA3KU, EA5BM, EA5ZF, EA6ACC, EA6FB)
Donor: Bob Cox, K3EST

Oceania-Pacific Rim
AH2R (Oprs. JG3RPL, JI3ERV, KH2/JHØUSD, JR7OMD)
Donor: Junichi Tanaka, JH4RHF

South America
CE3F (Oprs. CE3/SM3SGP, CE3FIP)
Donor: CQ Magazine

MULTI-OPERATOR, MULTI-TRANSMITTER
World
CN8WW (Oprs. DJ2QV, DK1BT, DK2OY, DK8LV, DK9IP, DL2MEH, DL3DXX, DL3NCI, DL6FBL, DL6LAU, DL8WPX, S51TA)
Donor: K2GL Memorial (Doug Zwiebel, KR2Q)

U.S.A.
KC1XX (Oprs. KC1XX, AD1C, K1EA, W1FV, K1GQ, N2IC, N3RD, KM3T, K6AW, DL7SI)
Donor: N6RJ Memorial (Bob Ferrero, W6RJ)

Europe
OH2U (Oprs. OH2BVI, OH2FT, OH2HE, OH2IW, OH2JQS, OH2JTE, OH2LUR/ES2RR, OH2MAM, OH2XX, OH4YR, OH6CT, OH7BX, OH7JR, OH8KXK)
Donor: Finnish Amateur Radio League

Japan
JA5BJC (Oprs. JA5BJC, JA5FDJ, JA5JCC, JH5FXP, JH5RXS, JR5JAQ, JR5VHU, JM1UMB, JS1OYN)
Donor: Ryozo Goto, JH3JYS

WORLD – SSB/CW COMBINED
CN8WW: 143,908,150
Donor: Alpha/Power, Inc.

CONTEST EXPEDITIONS
World Single Operator
ZD8A (Opr. Glenn Rattmann, K6NA)
Donor: Yankee Clipper Contest Club

World Multi-Single
ZA/S51F (Oprs. S51F, S57AW)
Donor: Carl Cook, AI6V

World Multi-Multi
A61AJ (Oprs. A61AJ, K1ZM, K3RA, KE3Q, N6ZZ, PA4AO, T93M, T93Y, T97M, WØUN, W3UR)
Donor: Bill Schneider, K2TT

SPECIAL – SINGLE OPERATOR AWARD
World SSB/CW Combined
P4ØE (Opr. Jose Carlos Cardoso Nunes, CT1BOH)
Donor: Hrane Milosevic, YT1AD

WORLD ALL BAND – UNDER 21 YEARS OLD
RI9C (Opr. Andy V. Chepurnoy, RA9CKQ)
Donor: Chuck Shinn, W7MAP

CLUB
World SSB/CW
Yankee Clipper Contest Club: 702,296,971
Donor: W1WY Memorial (*CQ* Magazine)

Non-USA SSB/CW
Bavarian Contest Club: 239,287,350
Donor: N6AUV Memorial
(Northern California Contest Club)

Attilio, I1BAY, QRP.

North American winner. Second place in Europe went to Peter from HA2A, while third went to Bosko, YT7TY. In the USA, John, K1RC, came very close to breaking the million mark in taking top USA honors. In second place was Alan, N3BJ/4. In Asia the top slot went to RA9SO, and a remarkable performance by JR4DAH shows what can be accomplished when you are isolated from the NA and EU population centers.

Assisted

This was the year the assisted category had a feast with multipliers. There were so many spots of juicy DX that you could have spent your whole weekend jumping from one to another. However, if you wanted a good score, running was the name of the game. With that in mind, John, ON4UN, piloted OT9T to the world high score. Along the way he set a new European assisted record. In world second place and setting a new USA record was Charles, K3WW. Charles has really perfected the assisted category to a high level over the last few years. He was followed closely by fellow Frankford Radio Club member Sig, N3RS. Way over in Brunei, Hajime, JO1RUR, put V8A on the map to garner fourth place world and the top non-USA/EU score. The fight for second through fourth place in Europe was fierce. Second place went to LY8X, with LY2BIL at the key, who just beat out Sergey, UTØU (UT5UDX op.), Ben, DF3CB, and Tomi, OH5NQ (OH6EI op.). Third place USA went to Noel, K2NG.

Multi-Op Single Transmitter

Making plans, gathering operators together, taking planes, and setting up the station at a location is repeated over and over by many of the multi-single and multi-multi DXpeditions you see in the results. It is not easy. Making sure that all the transmitters and receivers satisfy the distance rule is another challenge. The MS with "the mostest" this year was P3A. Putting together a multi-national team, they sure did it right and came up with a new world record. Close on their heels was the team at 8P9Z with an excellent UBN and a new North American record. Third was the fine team from Canada, VE3EJ, and a very close fourth was ZC4AKR.

After several years of building up the station at K1KI, Tom's crew put it all together to win the hotly contested USA top slot. Second place went to the ever-competitive team from the Frankford Radio Club, N2NU. Out in northeast Ohio, K8AZ had the third highest USA score. West of the Mississippi the top scorers were WXØB/5 and NØAV.

European competition was really rugged. After all the logs were checked, the winner and new European record holder was EA6IB. Close behind were the famous teams of RU1A and TM2Y, in second and third place, respectively.

Congratulations go to AH2R, S92CW, JH7PKU, CE3F, and UA7A, who either set new continental records or country records. Not being in a geographic position to make the top boxes most of the time, these stations must also be recognized as champions.

Multi-Op Multi-Transmitter

Figuring that doing the CQWW once a year was not enough fun, the team from CN8WW traveled back to their seaside location for the CW contest. Well, let's begin by saying they met their goal of winning. They convincingly demonstrated that zone 33 during the sunspot maximum is *the* place from which to operate. Not only did they set a new world record, they changed the dynamics of the MM competition. Being close to Europe they could take full advantage of the large number of European contesters. Comments from all over the world remarked on how loud they were—and they *could* hear! Quite a combination. Finishing second was the team from PJ4B. Operating in only their second CW CQ WW, PJ4B had to settle for top South American honors. That honor was fought over with the world third-place team of 4M7X. In fourth world place was the team at A61AJ. You have to take your hat off to their remarkable score, and they set a new Asian MM record. Rounding out the top six positions were efforts from 9G5AA and EA9EA.

Here in the USA, the top three MM's really locked horns. Big stations with hundreds of hours of construction and maintenance equals a big signal. Operating such a state-of-the-art station requires top operators. Setting a new USA MM record was the team of KC1XX located in New Hampshire. Located 400 miles southwest is W3LPL, whose team keyed Frank's station to second place. Third place went to Tim's crew at K3LR. The top team from the midwest was K9NS; they prevailed over K4VX/Ø and KØRF. From the far west the top scorer was W7RM, closely followed by N6AW.

The new European champion and record holder was the fine crew at OH2U. They orchestrated their way through the QRM and found enough QSOs and multipliers to edge out the hard-working team at RW2F. Third place went to DFØHQ, whose quads proved to be very competitive.

Putting in big MM efforts were the new Japanese record holder, JA5BJC; the wonderful effort by the Aurora team, KL7Y; and team Mongolia, JT1JA.

Special Mention

Every year hundreds of dedicated contesters head out on DXpeditions. In many cases the trips are first-time experiences from the "real" pile-up side. Once you have had that experience, you are really bitten by the DXpedition bug and you can't wait to do it again. DXpeditions bring about interest and fun for all entrants, and real excitement for the traveler. We would like to recognize many of DXpeditions that made the CQ WW contest so interesting: J45T, PJ4B, CN8WW, HBØ/HB9LF, 9G5AA, V26KZA/S51F, T32PO, V31JP, PØE, NP4A, ZB2X, LX4B, WP2Z, KP2A, 3E1DX, OHØV, 9H3J, 6Y3A, 6D2X, VP5DX, 4U1VIC, 4M7X,. J3A, V26K, WP3R, 9M6AAC, AH2R, V8A, E4/S53R, AP2N, XX9TDX, 9M6NA, H44MX, ZF2AM, S92CW, P3A, EA8/DJ1OJ, ZD8A, IH9P, VP2MGU, OX/N6AA, 6V6U, 3V8BB, J45KLN, OD4/OK1MU, EA6/DL8NBY, MJØAWR, FG5BG, 9M2JI, XV7SW, BY1DX, XU7AAV, VP5GN, 9G5ZW, OHØR, HI3/OH3UU, XE3/OH2CB, E41/OK1DTP, 9V1XE, BWØR, MU/OH3GI, VK7WB, HC8N, PQ5W, EA8EA, KP4/SM5AOE, 5B4AGD, 9H3MH, 9M8YY, OHØZ, 3W7TK, MU/OH9MM, 5NØW, VC1A, A61AJ, EA6IB, and ZX5J.

Special mention should be made of the following: The new Japanese all band record set by Masa, JH4UYB. The very close battle between ZX5J and ZS6EZ on 28 MHz and between SP2FAX and 9A9A on 7 MHz. The fine 28 MHz effort of KH7R. The low power top ten finish of XX9TDX and H44MX—rare mults in any contest! The great effort by BY1DX and XU7AAV, showing that when a great operator puts a rare place on the air, the call gets into a lot of logs. The fine low power scores of XV7SW, FK8HC, and EY8MM. The high power finishes of E4/S53R, A45XR, 5X1Z, UN7/AB8CK, and E41/OK1DTP. There were too many closely contested battles to mention them all, but check out JA3 low power 28 MHz, and low power all band in European Russia, the Czech Republic, Germany, Italy, Poland, Brazil, Sweden, and the Ukraine for starters. Of course, there were hundreds of one-on-one battles in many countries. Pay close attention in reading the results and you will find them all.

Team Contesting

When you gather together five contesters from anywhere or make up several teams from your own club, you have entered the Team Contesting category. This year's winner was Neiger's Tigers team #1, which finished with 42 million points. Four of the top six finishers were from Team Handkey. It was Handkey Team #2

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Solid state, no tuning required! 50 - 70 watts provides 550 watts out, all modes. Requires 13.5 VDC @ 80A for full output. Sold without power supply. Ship wt. 25 lbs.

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HIGH POWER TUNER

Model 238. Our superior "L" network utilizing heavy-duty, hand-built roller inductor. Matches up to 10:1 SWR at any phase angle. Handles 1500 watts with ease, even on 160 meters. Ship wt. 14 lbs.

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Model 937 - 13.8 VDC 11 amp Power Supply (14 lbs.)	$ 79.00
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TOP SCORES

WORLD

All Band

HC8N.....14,626,579
P40E.....13,577,850
EA8EA.....13,097,214
3V8BB.....11,729,116
ZD8A.....9,727,320
6V6U.....9,538,398
A45XR.....9,363,900
VP5GN.....8,408,202
E4/S53R.....8,391,987
W4AN.....8,279,616

28 MHz

ZX5J.....2,131,942
ZS6EZ.....2,102,496
9G5ZW.....1,801,182
3E1DX.....1,472,166
KH7R.....1,420,825
5X1Z.....1,352,608

21 MHz

5N0W.....1,603,641
9Y4VU.....1,385,976
AY1I.....1,317,400
E41/OK1DTP
.....1,229,728
PQ5W.....1,071,725
OH0V.....1,051,380

14 MHz

SP2FAX.....974,880
DJ7AA.....919,853
9A3GW.....904,722
UN7/AB8CK...774,228
OH8LQ.....738,164
LT1F.....713,236

7 MHz

OK1RF.....1,040,910
9A9A.....1,007,591
S59A.....863,028
M7Z.....826,485
KT3Y/4.....695,002
LZ9A.....694,212

3.5 MHz

VC1A.....513,663
ZB2X.....420,875
LY2TA.....360,685
W1MK.....346,332
HA8JV.....289,640
DF9LJ.....263,310

1.8 MHz

C4A.....261,489
4X4NJ.....177,744
SN3A.....158,445
S50U.....119,600
HA8BE.....96,628
S57M.....95,933

Low Power
All Band

FG5BG.....7,042,830
NP4Z.....5,442,660
SU9ZZ.....5,370,968
H44MX.....3,715,320
DA0FF.....3,410,784
N2BA.....3,347,190
XX9TDX.....3,333,666
S59AA.....3,120,620
K1RO.....3,021,344
K0EJ/4.....2,754,150

28 MHz

CX5AO.....1,082,390
WP2Z.....882,576
FK8HC.....661,055
EY8MM.....512,796
DL1LH.....498,750
7M1MCT.....492,156

21 MHz

EA8FT.....654,408
VE6BF.....620,739
XV7SW.....583,766
VC7A.....515,637
YT0C.....508,546
9A5Y.....474,846

14 MHz

CX9AU.....580,320
RJ9J.....576,387
EN1I.....316,800
VE6EX.....295,023
UA0SAD.....212,003
UA9CBM.....195,881

7 MHz

EA8CN.....537,840
S57DX.....494,431
HI3K.....402,875
PA3AAV.....399,828
RU4PL.....324,348
YZ7ED.....258,150

3.5 MHz

TA3D.....195,889
RK9AY.....112,694
CO8DM.....84,282
SP9BBH.....74,390
IV3KTY.....68,284
YU1YV.....64,032

1.8 MHz

9A7R.....94,822
UN2O.....45,778
YU1CC.....18,550
DJ3RA.....15,180
9A3RE.....12,788
SP6LV.....9,655

QRP
All Band

P40W.....5,024,800
LY2FE.....1,379,329
VE3KZ.....1,349,316
HA2A.....1,320,662
YT7TY.....1,221,597
K1RC.....953,670
SM3C.....944,168
RA9SO.....902,761
N3BJ/4.....901,296
JR4DAH.....861,120

Assisted
All Band

OT9T.....8,511,750
K3WW.....8,182,098
N3RS.....7,438,200
V8A.....6,889,770
K2NG.....6,410,180
K2TW.....5,720,357
KI1G.....5,645,250
K2BU.....4,831,386
W3EEE.....4,815,628
N2MM.....4,751,500

Multi-Operator
Single Transmitter

P3A.....19,243,476
8P9Z.....18,711,252
VE3EJ.....12,803,210
ZC4AKR....12,639,016
EA6IB.....11,670,260
K1KI.....11,590,494

Multi-Operator
Multi-Transmitter

CN8WW....70,713,270
PJ4B.....47,528,180
4M7X.....40,142,880
A61AJ.....38,789,751
9G5AA.....34,918,107
EA9EA.....30,316,678

USA

All Band

W4AN.....8,279,616
K1AR.....8,046,695
W1KM.....7,583,360
K1ZZ.....7,099,542
K5ZD/1.....6,570,312
KQ2M/1.....6,500,892
K1DG.....5,942,552
K3ZO.....5,937,057
W1WEF.....5,718,249
N2LT.....5,490,882

28 MHz

K1RM.....789,330
K5RX.....655,044
K8MFO.....617,430
N0NR.....579,636
K4EA.....559,680
W6NL.....557,100

21 MHz

K8DX.....864,999
N9AG/8.....797,849
AA4GA.....690,536
N2MF.....687,357
NN4T.....633,294
NQ4I.....589,632

14 MHz

K9XD.....292,334
K9CAN.....123,114
W2ZI.....83,636
W6DCC.....80,087
N7WA.....79,394
WA6IQM/7.....60,756

7 MHz

KT3Y/4.....695,002
K4XS.....687,516
K7EM.....554,952
KR1G.....515,460
K8PO/6.....387,552
K9AN.....296,240

3.5 MHz

W1MK.....346,332
K5NU.....96,728
W0AH.....26,166
K8MD.....23,622
W4GD.....14,760
K2LP/1.....12,096

1.8 MHz

W8UVZ.....13,774
K4RX.....12,834
K1VW.....12,696
K4TEA.....12,408
N4UK.....11,977
W2VO.....4,230

Low Power
All Band

N2BA.....3,347,190
K1RO.....3,021,344
K0EJ/4.....2,754,150
K1VUT.....2,555,175
KM1X.....2,256,638
WD4AHZ.....2,177,055
K1VR.....2,142,112
KB1EAX.....2,075,532
KJ9C.....1,750,960
K1NO.....1,710,912

28 MHz

W4WA.....298,571
WB4TDH.....283,300
N5AW.....264,231
K0RS.....253,800
WO4O.....245,280
K9WA.....239,100

21 MHz

N4MO.....464,512
WW3S.....423,776
KU0C/4.....410,711
K6OY.....280,176
AE0Q.....179,196
K7DBV.....171,872

14 MHz

W0ETT.....65,578
W3KHQ.....55,990
N9WI.....41,644
KB3EHY.....32,220
W8UMR.....17,702
AF8C.....6,901

7 MHz

W2MMD.....90,415
K9MMS.....88,680
WB2DVU.....83,579
W5CWQ.....60,480
KU6T.....7,841
K5BN.....6,664

1.8 MHz

K1PX.....2,628
K4LDR.....420

QRP
All Band

K1RC.....953,670
N3BJ/4.....901,296
N8ET.....809,992
N0KE.....784,080
N7IR.....748,071
N1TM.....687,492
W6JTI.....624,530
N9CIQ.....497,169
WA3NKO/4.....462,927
W6YJ.....416,160

Assisted
All Band

K3WW.....8,182,098
N3RS.....7,438,200
K2NG.....6,410,180
K2TW.....5,720,357
KI1G.....5,645,250
K2BU.....4,831,386
W3EEE.....4,815,628
N2MM.....4,751,500
N3RR.....4,540,338
K5MA/1.....4,477,640

Multi-Operator
Single Transmitter

K1KI.....11,590,494
N2NU.....11,213,664
K8AZ.....9,636,380
K1IR.....7,481,942
K8LX.....6,880,962
W2AA.....6,586,408

Multi-Operator
Multi-Transmitter

KC1XX.....24,602,524
W3LPL.....23,539,901
K3LR.....23,379,714
K9NS.....16,032,942
K1TTT.....14,223,600
K2LE/1.....13,651,588

EUROPE

All Band

LY6M.....7,140,784
GI0KOW.....6,918,708
OH0Z.....6,212,463
S58A.....6,203,967
SP7GIQ.....5,921,220
4N9BW.....5,269,900
OH5LF.....5,255,874
S50A.....5,148,900
OZ1LO.....4,658,952
G0IVZ.....4,233,732

28 MHz

GW3YDX.....990,120
SM2EKM.....921,193
DL1IAO.....818,432
OK2RZ.....780,922
YZ9A.....678,600
YL3CW.....657,354

21 MHz

OH0V.....1,051,380
9A5W.....951,993
G4BUO.....835,086
ON5UM.....626,500
G5G.....626,316
RZ3QU.....556,864

14 MHz

SP2FAX.....974,880
DJ7AA.....919,853
9A3GW.....904,722
OH8LQ.....738,164
HG3DX.....598,210
ES7RE.....593,217

7 MHz

OK1RF.....1,040,910
9A9A.....1,007,591
S59A.....863,028
M7Z.....826,485
LZ9A.....694,212
S57AL.....614,955

3.5 MHz

ZB2X.....420,875
LY2TA.....360,685
HA8JV.....289,640
DF9LJ.....263,310
DL7ON.....252,585
EW1WZ.....190,670

1.8 MHz

SN3A.....158,445
S50U.....119,600
HA8BE.....96,628
S57M.....95,933
LY2VAD.....90,440
IT9BLB.....78,020

Low Power
All Band

DA0FF.....3,410,784
S59AA.....3,120,620
EW2CR.....2,494,010
DF4SA.....2,452,064
IK0YVV.....2,439,444
G3WGV.....2,369,120
LY3BA.....2,352,674
I3JSS.....2,323,517
RA1ACJ.....1,933,792
OK2PP.....1,875,976

28 MHz

DL1LH.....498,750
UA4LL.....433,488
OK2PAY.....389,693
YU7WW.....344,396
DJ7IK.....318,636
HG8C.....318,006

21 MHz

YT0C.....508,546
9A5Y.....474,846
MU/OH9MM...411,635
S50N.....380,856
SP9XCN.....368,160
8S7X.....286,380

14 MHz

EN1I.....316,800
YU1HFG.....160,776
UA3ABJ.....159,800
Z31CN.....140,251
RA3SL.....136,347
OE2GEN.....119,272

7 MHz

S57DX.....494,431
PA3AAV.....399,828
RU4PL.....324,348
YZ7ED.....258,150
S54A.....234,150
S59KW.....219,583

3.5 MHz

SP9BBH.....74,390
IV3KTY.....68,284
YU1YV.....64,032
9A7T.....61,760
S52GO.....57,780
UR3PDT.....56,056

1.8 MHz

9A7R.....94,822
YU1CC.....18,550
DJ3RA.....15,180
9A3RE.....12,788
SP6LV.....9,655
HB9APJ.....7,524

QRP
All Band

LY2FE.....1,379,329
HA2A.....1,320,662
YT7TY.....1,221,597
SM3C.....944,168
HA5BSW.....856,826
YU1LM.....658,086
G4ELZ.....468,948
I0ZUT.....443,704
RZ6HX.....439,570
UA4YJ.....421,648

Assisted
All Band

OT9T.....8,511,750
LY8X.....4,431,636
UT0U.....4,370,327
DF3CB.....4,343,312
OH5NQ.....4,178,694
OK2FD.....3,263,351
YU7NU.....3,242,525
DJ2YA.....2,979,200
DK5QN.....2,955,615
UT5UGR.....2,718,247

Multi-Operator
Single Transmitter

EA6IB.....11,670,260
RU1A.....11,360,022
TM2Y.....10,893,247
OM8A.....9,799,288
IR4T.....9,772,505
IQ4A.....9,506,760

Multi-Operator
Multi-Transmitter

OH2U.....22,244,067
RW2F.....21,568,933
DF0HQ.....20,013,588
GM7V.....16,595,772
HG6N.....15,457,260
PI4COM.....12,721,272

OD5/F5SQM, Jean Paul, F6FYA, and his XYL.

ZONE LEADERS SINGLE OPERATOR

Zone	Call	Score	Zone	Call	Score
1	KL7RA	2,899,666	21	A45XR	9,363,900
2	VE2IM	8,158,683	22	VU2PAI	2,080,166
3	W6EEN	4,008,744	23	UAØYAY	473,760
4	W9RE	5,033,959	24	XX9TDX	3,333,666
5	W4AN	8,279,616	25	JH4UYB	5,139,152
6	XE1V	957,307	26	XU7AAV	4,659,280
7	3E1DX	1,472,166	27	KH2/K4ANA	1,297,115
8	VP5GN	8,408,202	28	9M6NA	7,402,265
9	P4ØE	13,577,850	29	VK8AV	1,372,572
10	HC8N	14,626,579	30	VK2IA	2,312,019
11	ZX5J	2,131,942	31	*V73CW	1,922,760
12	CE3AA	2,685,690	32	ZL6QH	2,213,710
13	AY1I	1,317,400	33	EA8EA	13,097,214
14	GIØKOW	6,918,708	34	*SU9ZZ	5,370,968
15	LY6M	7,140,784	35	6V6U	9,538,398
*16	RM4W	4,073,976	36	ZD8A	9,727,320
17	EX8W	5,927,040	37	5X1Z	1,352,608
18	RVØAM	2,257,270	38	ZS6EZ	2,102,496
19	*RUØLL	1,839,096	39	No Entry	
20	E4/S53R	8,391,987	40	OX/N6AA	4,146,723

** Low Power*

that edged out the Handkey Team #4 and Contest Club Finland Limitless teams to take second place. Several of the teams reflected specialties. Join the fun and create your own team of five members. Look at the rules (September *CQ* or the CQWW web site) and send in the list.

Clubs

The Club Scores box reflects the addition of SSB and CW entries. As a matter of interest, the total points submitted for both contests by everyone was 7.244 billion!! Quite a fantastic number, and it is presented here for the first time in any contest. What is really remarkable is that the winning club score for the world was achieved by the Yankee Clipper Contest Club, with 702 million points. This means that 10% of all points submitted from anywhere came from the YCCC. The second-place winner was the Frankford Radio Club with 561 million points, followed by the Potomac Valley Radio Club with 247 million. DX competition was a bit closer, with top honors going to the Bavarian Contest Club with 239 million points, followed by Contest Club Finland with 200 million and the Rhein-Ruhr DX Association with 183 million. The grand total for these six clubs was 2.132 billion points! Clubs do put people on the air. Why not join the fun and join a club? Look over the list in the Club Scores box and find one near you. You can also check out <http://www. cqww.com> for more club information.

New All-Time Records

The following champions set new all-time CW records for the world and their continents.

World: AB HC8N (N5KO); 28 ZX5J (N6TJ); 1.8 C4A (9A3A/5B4ADA); L28 CX5AO; L3.5 TA3D; QA P4ØW (W2GD); Q28 LU7EE; A28 NP4A (DL2CC); A21 WP3R (DL5XL); MS P3A; MM CN8WW.

South America: AB HC8N (N5KO); 28 ZX5J (N6TJ); LA CE3AA; L28 CX5AO; QA P4ØW (W2GD); Q28 LU7EE; MM PJ4B.

Africa: 28 ZS6EZ; L21 EA8FT; MM CN8WW.

Asia: 28 5B4AGD (YT6A); 21 E41/OK1DTP; 1.8 C4A (9A3A/5B4ADA); L14 RJ9J (RA9JR); L21 XV7SW (SM5MX); L3.5 TA3D; Q28 JR3RWB; A28 UN7FZ; A14 RA9AA; A7 JE1CKA; MS P3A; MM A61AJ.

North America: L28 WP2Z; Q21 NA4CW; Q14 KR2Q; Q7 KVØQ; AA K3WW; A28 NP4A (DL2CC); A21 WP3R (DL5XL); MS 8P9Z.

Oceania: AB 9M6NA (JE1JKL); 28 KH7R (KH6ND); 3.5 KH2/N2NL; LA H44MX (K1XM); L28 FK8HC; AA V8A (JO1RUR); MS AH2R.

Europe: AB LY6M (LY1DS); 28 GW3YDX; 21 OHØV (OH6LI); 7 OK1RF; L21 YTØC (YU7CB); QA LY2FE; Q28 OH7FF; Q21 ES1CW;

TOP SCORES IN VERY ACTIVE ZONES

Zone 3

W6EEN	4,008,744
K7RAT	3,466,386
W7GG	3,381,516
W2VJN/7	2,842,605
AA7A	2,750,069
K4XU/7	2,398,914
N6TU	1,833,720
N6CW	1,486,706
W7OM	1,044,151
KG7H	970,746

Zone 4

W9RE	5,033,959
K8GL	4,024,440
K5MR	3,516,792
VE3OI	3,413,916
K9MA	3,170,959
N4GN	3,127,448
K5YAA	3,033,630
K4AB	3,025,770
KT8X	2,968,031
KØEJ/4	2,754,150

Zone 5

W4AN	8,279,616
VE2IM	8,158,683
K1AR	8,046,695
W1KM	7,583,360
K1ZZ	7,099,542
K5ZD/1	6,570,312
KQ2M/1	6,500,892
K1DG	5,942,552
K3ZO	5,937,057

Zone 14

GIØKOW	6,918,708
OZ1LO	4,658,952
GØIVZ	4,233,732
*DAØFF	3,410,784
EA5FV	2,960,808
MJØAWR	2,748,434
*DF4SA	2,452,064
EA2IA	2,443,258
G3TXF	2,437,394
*G3WGV	2,369,120

Zone 15

LY6M	7,140,784
OHØZ	6,212,463
S58A	6,203,967
SP7GIQ	5,921,220
4N9BW	5,269,900
OH5LF	5,255,874
S5ØA	5,148,900
LY2IJ	4,082,305
LY2CY	3,966,309
OH7A	3,542,548

Zone 16

RM4W	4,079,160
*EW2CR	2,494,010
UX7IA	2,431,765
EU1DX	2,314,920
UA4WA	2,065,190
RW1ZA	1,942,230
EU1MM	1,690,200
RU6AV	1,578,528
*RA3AF	1,354,200
RZ3AA	1,202,432

Zone 25

JH4UYB	5,139,152
JS3CTQ	3,370,140
JA8RWU	3,290,800
*JEØUXR	2,267,954
*JL1ARF	2,215,448
JH2BCN	1,758,291
JQ6NAW	1,734,700
*JH8SLS	1,680,426
JA9CWJ	1,558,374
JF3CCN	1,439,064

**Low Power*

BAND-BY-BAND BREAKDOWN—TOP ALL BAND SCORES

Number groups indicate: QSOs/Zones/Countries on each band

WORLD TOP SINGLE OPERATOR, ALL BAND

Station	160	80	40	20	15	10
HC8N	351/19/38	713/27/75	1144/33/93	1341/34/104	1498/37/120	1954/35/116
P4ØE	301/12/23	707/27/73	1453/31/100	952/37/107	1296/36/114	2011/34/121
EA8EA	195/13/49	633/22/64	842/28/70	1495/36/106	1363/37/114	1916/36/116
3V8BB	305/12/59	1000/19/77	1732/31/100	853/31/100	817/32/97	1505/34/105
ZD8A	7/6/6	311/22/59	711/26/77	953/36/94	1153/33/98	2371/37/124
6V6U	32/10/18	193/16/55	999/26/81	1194/34/95	1089/33/104	2001/32/103
A45XR	69/7/37	350/16/60	1044/23/82	1087/33/104	1235/32/101	1532/34/108
VP5GN	249/15/36	416/20/60	1003/24/86	963/31/96	1127/30/102	1643/33/105
S53R	158/10/52	441/15/65	1029/27/90	1405/34/102	543/31/86	1334/34/93
W4AN	41/17/32	158/23/69	1247/33/98	764/36/106	1018/34/108	1073/32/108

USA TOP SINGLE OPERATOR, ALL BAND

Station	160	80	40	20	15	10
W4AN	41/17/32	158/23/69	1247/33/98	764/36/106	1018/34/108	1073/32/108
K1AR	26/10/17	326/20/74	835/30/95	1035/38/115	851/36/112	1104/32/106
W1KM	68/16/42	359/24/79	728/28/87	883/34/97	698/28/89	1283/35/97
K1ZZ	42/14/25	343/21/72	523/25/95	810/37/107	734/30/93	1325/31/107
K5ZD/1	43/14/29	368/19/61	820/25/82	788/34/100	854/30/87	1062/30/93
KQ2M/1	23/12/20	222/20/61	695/29/90	736/35/103	916/33/104	1079/32/103
K1DG	32/12/22	195/18/66	876/30/91	767/33/93	813/31/102	852/26/92
K3ZO	15/6/15	81/14/55	714/28/74	801/34/95	1180/33/101	934/28/84
W1WEF	25/10/19	195/18/66	652/29/88	819/33/91	909/34/93	807/28/94
N2LT	35/17/29	141/16/55	659/27/94	575/33/93	700/31/94	1009/32/100

WORLD MULTI-OPERATOR SINGLE TRANSMITTER

P3A	264/13/61	1121/27/98	1535/35/121	1825/39/136	1782/39/136	1761/38/139
8P9Z	194/16/33	475/27/89	1995/30/118	2242/40/141	1462/40/149	1977/39/139
VE3EJ	179/19/48	491/29/96	1410/38/128	1225/40/147	1245/39/145	1023/36/136
ZC4AKR	169/9/58	877/16/76	1144/25/100	1726/32/107	1350/34/107	1501/29/96
EA6IB	66/10/66	826/24/97	1581/35/127	1151/38/128	1761/40/129	1327/39/135
K1KI	55/20/50	284/27/89	1163/38/121	1071/40/140	1096/38/141	1081/36/139

USA MULTI-OPERATOR SINGLE TRANSMITTER

K1KI	55/20/50	284/27/89	1163/38/121	1071/40/140	1096/38/141	1081/36/139
N2NU	50/17/48	353/29/100	1043/38/123	1145/39/147	993/39/145	981/37/140
K8AZ	39/17/35	97/27/85	1023/36/117	861/40/138	986/37/136	1179/36/141
K1IR	25/11/24	505/25/84	808/29/105	862/36/126	877/33/123	826/32/126
K8LX	23/10/16	109/22/72	722/34/108	580/39/123	890/39/133	1014/35/130
W2AA	28/14/26	105/24/84	968/35/119	754/38/134	443/36/127	857/34/126

WORLD MULTI-OPERATOR MULTI-TRANSMITTER

CN8WW	1694/24/100	3248/35/121	4358/40/141	4837/40/159	4319/40/161	4612/40/161
PJ4B	777/22/55	1612/30/102	3446/37/136	3972/40/160	4133/40/156	3949/39/148
4M7X	630/21/60	1578/27/96	3196/38/129	3290/40/144	3604/40/152	3464/37/131
A61AJ	768/20/74	1913/34/115	3303/39/141	3509/40/154	3208/40/156	3110/40/148
9G5AA	112/15/46	651/25/80	2300/35/129	3685/40/147	3820/40/153	3229/40/153
EA9EA	49/5/28	1447/26/86	2992/38/135	3066/36/125	3080/39/143	2816/37/128

USA MULTI-OPERATOR MULTI-TRANSMITTER

KC1XX	291/23/63	1040/34/116	2119/40/138	2155/40/155	2028/38/150	1947/38/148
W3LPL	197/25/67	823/31/107	1812/38/135	2114/40/158	2102/40/154	2053/37/151
K3LR	149/22/56	468/31/103	1921/39/134	2162/40/154	2277/40/155	2020/39/150
K9NS	220/25/54	401/30/92	1159/38/128	1579/40/145	1701/39/139	1842/38/141
K1TTT	139/18/46	559/28/97	1363/37/120	1817/40/151	1631/37/139	1117/35/130
K2KE/1	93/16/44	297/21/77	1504/35/120	1918/40/139	1190/38/128	1195/35/127

AA OT9T (ON4UN); A28 DL4NAC; A21 OH6AC (OH6CS); MS EA6IB; MM OH2U. You can check out the records for every country for every mode at <http://www.cqww.com>. Look under "All Time Records."

Comments

The CQ WW DX 1999 contests will go down as the largest—ever. Over 7500 logs were received and processed. This, as you can imagine, was a massive undertaking. It was made possible by the thousands of contesters from over 125 countries who sent in e-mail logs. The adjudication of such a large contest is only possible through the use of computers. It was only a few years ago that there were 15 cartons of paper logs sitting at my QTH. This time the number of boxes was down to four. Of those logs about 40% were computer-generated printouts. It would be helpful, if you use a computer in the contest, to take a few minutes and send in your log via the internet. It is easy and cheaper than mailing. If you do not have direct access, maybe a friend does and you can send it that way. Please send your SSB CQ WW logs to <ssb@cqww.com> and your CW logs to <cw@cqww.com>.

The overall skill of contesters who submit an electronic log is improving with every year. It is very encouraging to see this. The UBN report that each entrant can retrieve serves the purpose of providing a way for the entrant to improve. We receive hundreds of letters each year from entrants asking questions and passing along their thanks for this special service the CQ WW Contest Committee provides.

TEAM CONTESTING

1. Neiger's Tigers #1: 42,058,472. P4ØE(CT1BOH), HC8N(N5KO), ZD8A(K6NA), N6AA/OX.
2. Handkey Team #2: 31,293,680. K2UA, FG5BG(K9NW), K7RAT, W1KM, W4AN.
3. Handkey Team #4: 28,252,291. VE2IM(VA3UZ), K5ZD/1(W2SC), W6EEN(K6LA), VP5GN(K5GN), K6RO.
4. CCF Limitless: 26,245,806. EA8EA(OH2MM), BY1DX(OH2PM), OH5LF(OH1WZ), OH5NQ (OH6EI), OH6YF.
5. Handkey Team #3: 23,101,988. W9RE(N9RV), N2NT, K4AB, N4ZR, IH9P(OL5Y).
6. Handkey Team #1: 21,239,512. K1AR, K8GL, AA4S, K1DG, KB3AFT.
7. Team Nippon: 17,020,036. 9M2TO(JAØDMV), 9M6NA(JE1JKL), 9M8YY(JR3WXA), V8A(JO1RUR).
10. Dream Team: 14,778,185. LY2KM, LY2LA, LY2MM, LY5W(LY1DR), LY6M(LY1DS).
11. CCF Max-3-Towers: 11,100,577. XX9TDX(SMØGNU), OH4JFN, OH7A(OH7MA), OH6NIO, OH3WW(OH1HS).
12. Neiger's Tigers #2: 9,999,347. W2VJN/7, ZX5J(N6TJ), P4ØW(W2GD).
13. Team Tennessee Uno: 8,404,732. KØEJ/4, K4LTA, K4RO, NA4K.
14. Bay Code Whistlers: 7,775,379. DAØFF(DL2HBX), DF4SA, DL8UD, 9H3MH(DJ9MH), DKØDO(DL1MGB).
15. Beverly Contest Group: 7,689,386. W1ZT, K1EO, K1JE, W1NT, W1TE.
16. CCF Limited: 6,199,430. MU/OH9MM, OH8BQT, OH6AC(OH6CS), OHØV(OH6LI), OH1JD.
17. Lithuanians – Not High Power: 5,212,697. LY1BW, LY2FE, LY2FN, LY3BA, LY3IW.
18. Kentucky Contest Group: 5,105,454. K4AO, KS7O/4, W9AU, K4FXN, N4GN.
19. Team Tennessee Dos: 1,491,090. NN4T, N4IR, W9WI, N4KN, WO4O.
20. CCF No Sweat!: 648,480. OH2LU, OH4A(OH4JLV).
21. CCF Part-Timers: 575,054. OH2BCI, OH5JOC, OH6OS.
22. Team Isla Delatorre: 166,535. EA1/YV5NIQ, EA1EB, EA1AAW, EA1ATQ.

Thanks

First of all, the CQ WW Contest Committee wants to thank you, the entrants, for taking the time to send in an electronic log. It really makes a difference. And none of the results would be possible without the efforts of the 40 or so people behind the scenes who make it happen. The CQ WW e-mail robot was set up and is maintained by John, K2MM. Once you send your log and summary to either <ssb@cqww.com> or <cw@cqww.com>, it is processed, decoded, and massaged by Larry, N6TW. Larry has put in many hours to make the log processing efficient and accurate. He really is an unsung hero of contesting. He processes each log and sends the information to Dick, N6AA, and K3EST. The amount of effort Dick puts into producing an accurate, state-of-the-art score analysis is herculean. N6AA and K3EST are in contact almost daily from late November to late August. Once the logs are ready to produce a UBN report, each log checker reviews the logs in his care trying to find any errors by the entrant or by the analysis. The log checkers are K1DG, N3ED, KR2Q, K6NA, N6ZZ, W7EJ, N9RV, N2NC, K3WW, and K3LR.

Each year we receive some disks that are in a weird format or are damaged. A group headed by W3ZZ—N5NJ, I2UIY, and JE1CKA—solves these problems or asks the entrant to resubmit the log. In addition to log checking, Phil, N6ZZ, serves as a sanity check at each stage of the creation of the master database. Each year I rely on the sage advice of our special advisors: K3ZO, N2AA, N8BJQ, G3SXW, S5ØA, KR2Q, and N5KO. The CQ WW uses the

EUROPE TOP SINGLE OPERATOR, ALL BAND

Station	160	80	40	20	15	10
LY6M	127/9/49	488/18/81	1163/35/116	625/33/89	1354/33/107	877/35/116
GIØKOW	291/8/53	783/21/88	906/26/91	828/36/104	987/35/104	1036/37/113
OHØZ	240/10/47	396/18/66	704/29/87	1322/34/96	862/33/102	1083/35/116
S58A	55/8/42	272/18/75	1074/37/119	547/33/106	738/36/110	1303/39/130
SP7GIQ	159/12/46	287/17/55	1116/29/88	744/29/72	1177/33/92	996/28/79
4N9BW	201/12/64	366/17/77	1249/28/95	906/31/97	791/33/105	447/32/107
OH5LF	72/10/41	276/22/76	604/27/89	926/35/95	748/36/115	825/36/120
S5ØA	65/7/42	517/22/74	1012/31/98	582/34/91	875/35/102	550/37/102
OZ1LO	259/10/57	458/17/58	513/26/76	613/31/84	821/29/81	997/33/99
GØIVZ	253/12/49	416/15/64	755/24/80	561/27/85	597/29/88	908/31/95

EUROPE MULTI-OPERATOR SINGLE TRANSMITTER

EA6IB	66/10/66	826/24/97	1581/35/127	1151/38/128	1761/40/129	1327/39/135
RU1A	95/15/63	351/30/103	1311/39/137	1167/40/141	1025/38/143	1301/40/150
TM2Y	64/14/63	640/25/99	1337/36/123	834/40/140	1392/40/133	1311/38/136
OM8A	131/11/63	474/24/93	1549/37/126	848/40/130	875/39/135	1423/40/136
IR4T	208/15/71	494/26/98	1103/36/119	903/39/140	882/40/136	1487/39/136
IQ4A	62/11/62	281/30/109	1138/37/122	877/39/139	1039/37/138	1370/38/146

EUROPE MULTI-OPERATOR MULTI-TRANSMITTER

OH2U	718/19/77	1173/33/118	2251/40/144	2729/39/146	2317/40/145	1766/40/156
RW2F	1002/21/89	1663/37/121	2307/40/140	2484/40/145	1937/40/145	1708/40/149
DFØHQ	731/16/75	1525/34/115	2690/40/140	1868/39/135	1997/40/145	1860/40/147
GM7V	890/15/71	1394/27/106	2014/39/134	1843/40/136	1961/40/141	1952/36/141
HG6N	727/14/74	1168/22/94	2009/37/126	1921/38/134	1930/40/133	1848/39/143
PI4COM	559/15/66	1177/20/91	1348/35/124	1776/37/132	1827/39/134	1289/40/143

constantly updated software developed by Tree, N6TR, in order to create the database. Translations of the rules into Spanish, Japanese, German, and French were done by EA3DU, JE1CKA, DL6RAI, and F6BEE. In addition, many DX advisors provide reliable country databases. The DX advisors are CT1BOH, DL6RAI, EA3DU, F6BEE, G3SXW, HSØ/G4UAV, I2UIY, JE1CKA, OH2KI, OH2MM, ON6TT, PY5EG, S5ØA, UA9BA, and VE3EJ.

Congratulations to all the winners! Join the CQ WW fun in 2000!

73, Bob, K3EST

DX QRM

Fabulous conditions, but activity was low on 160...***4X4NJ.*** Weather was not vy nice. Fog all around! At Sunday afternoon started troubles with power-network. 170 VAC was not enough for proper operation of TS930S. Last few hours I was running only 50W. After all, operation was finished early evening, more than 6 hours before the end of the game...***9A2U.*** Very hard to work US stations from here with 100W. Only I could work few Big Ear stations!...***9M2JI.*** Due to family and working commitments, decided to operate single 160m. Called by HC8N, PJ4B, 4M7X, 8P9Z, JT1JA, VQ9IO, and many more. Missed my 1000 QSO goal, but looks as if at the end I'll get a new world record instead...***C4A (9A3A/5B4ADA).*** Sunshine, sandy beaches, and CQWW. What a way to vacation! Thanks to everyone who called ...***C6AGY (ND6S).*** Very good DX cndx on 14 MHz this weekend. It was a real victory for my wire Vee dipole and old FT-707. I didn't catch zone 2, but at the end HC8N gave me zone 10...***CX9AU.*** Glad I could use the great antenna system of Ben, DL6FBL, during *the* contest. Really had a blast. Often could break pile-ups on the first call. Found out only after the contest that the targeted EU Low Power record was at 3.4M (EA7CEZ, 1994) rather than 2.6M (S59AA, 1998). Should be a good incentive to go for the real record in 2000...***DAØFF (DL2HBX).*** I came so close to the European Single/Assisted record. If the contest had lasted only another 20 minutes...4 hours without the linear due to recordings in the nearby recording studio despite prior agreements...***DF3CB.***

All antennas were running fine on Thursday already! Unfortunately, TX and PS developed some problems right before the contest, so no time for sleep again...had to take 7 hours off from Saturday to Sunday. Used second radio for the first time; did not use it very much but learned a lot and hope to improve it. DXing during the test was too tempting, so I spent too little time running stations myself...2.5 million is my all-time high; happy I did it with low power. Many thanks again for running the contest!...***DF4SA.*** First time during the last the 36 years of WW DX we had a broken 160m vertical and 40m beam due to heavy wind...***DLØKF.*** Due to a failure of my PA I couldn't work as effectively as the last years, but I think I managed it ok. Again it was great fun and I'm looking forward to CQ WW in 2000...***DL1EMH.*** Nice condx. My first WW DX with all 40 zones on 10m. See you in next "Millennium WW DX 2000"...***DL1LH.*** Hey, this was *big fun!!* Originally I had plans for doing my first WW DX since 1991 in a serious way. Well, things turned out to be not in my favor. I arrived at the station (which is at my parents' home, 300 miles from where I live now) at 21:30 local being very tired even before takeoff!! So I decided to go for 1500 Q's and/or 1.5 million pts to add to the RRDXA score. I have never ever seen the bands so crowded. There was a 4 minute period on 15m where I worked all continents in a row, with the antenna beaming northeast! Does it get any better than that?! It was great to see all the activity, meeting old and new friends. Congrats to all the real big scorers from all over the planet and thanks to my YL for trying to understand how this can be fun!...***DL3YBM.*** Switched on my radio to give some points to good friends. Left the chair 20 hours later. Millennium condx...***DL7ALM.***

Super condxs! Sorry that those Asian stations didn't stay longer than the EUs were there.

A new USA record was set by Bill, W4AN.

HC8N was operated by Trey, N5KO, to a new world record.

With 100W you have to be there when the bands open up otherwise you don't come through in the pile-ups. Managed again to improve result from year before, this time with almost 10% increase in points. Was this the highest score that I can reach from here?...***EA8CN.*** Super contest. Storm force winds kept the tower down again this year and shifted the beam 90 degs out of true so made beam turning fun. You know the wind's strong when it holds the beam steady against the rotors torque—Hi! New personal best though, so am very happy...***EI6FR.*** I had an opportunity to taste low power entry, spending about 18 hours on the air, wasting my time breaking through the pile-ups. But that is good experience ...***EO1I (UT1IA).*** I am sorry; problem with electricity in north Moldova ...***ERØN (UT7ND).*** As usual a lot of activity, fun, fatigue. Anyway, everybody is satisfied. Thank you for a great contest...***EW1WZ.*** Thanks for the contest. Good propagation to States and big activity from this side makes a lot of fun...***EW6GB.*** It's a new radio club, and it was the first time we were together in a contest. Some operators were in their first contest...***F8KHZ.*** First time as Single Op from the "other side!" Great conditions, great ops, great fun!...***FG5BG (K9NW).*** Worked several BY, BV, JA. The new antenna seems very good on 10 meters. Most Asian came from the south during night...***FM5BH.***

DXCC in a weekend, I never thought it possible! ...***GØDEZ.*** What a blast! The best contest of the year without a doubt. After success on 15m LP last year, I tried 10m this time. Had some great runs into the USA, but struggled to find some "easy" countries when in Search & Pounce mode. Very pleased to make DXCC with 100W in a weekend—unassisted ! Tried using my reserve TS850 (albeit one without a CW sidetone) to search for mults whilst calling CQ for the first time, but will have to improve my technique here. Gales not too bad this year, no floods either (yippee) ...***GØMTN.*** My first CW CQ WW. It was a little bit too fast for me but great fun. I must do it again next year...***GØSAH.*** Pleased to work AH2R. Great ears at that end and A61AJ who had a fab signal into Europe...***GØWAT.*** Great contest; broke all records. Condx very good but found some of the "pile-ips" hard to break with the 5W. Had a great time; roll on next year...***G3LHJ.*** There's definitely a high correlation between the CQ WW CW weekend and strong gales in Devon. The antennas were all being smashed about by the high winds again this year...***G3TXF.*** Can't compete with GIØKOW all band from plain old G, so I had a shot at 15m and enjoyed the different experience. Beat the 10-year old record of OH6M CW, but I was not the only one to do that. Cndx good, but not as good as they should be at the top of the cycle. The band closed quite early both days...***G4BUO.***

Age 83 and managed my best score ever. Computer kept saying zone 5 for all W4's and hope I logged 4 when given it. After studying UBN for 1997 for G6QQ and 1998 for V29QQ tried to check doubtful calls and deleted some. Not everyone says "r" or "tu" so uncertain sometimes if I have had a valid QSO though it may have been okay ...***G6QQ.*** I entered this year's contest as a check log entry as the dipole was practically useless on the LF bands after storm damage (although 5C8M was worked on 160m prior to the contest!). The new Yagi allowed me to hold a frequency throughout the contest. I called CQ all the time with only the last hour searching & pouncing to get the score past 2M. My aim was to have as many QSOs as possible and to avoid last year's comment, "Where were you?" Although I guess many missed me on the LF bands, I achieved my objective and had fun with the pile-ups... ***GD4UOL.*** Thanks for running the contest. Might have had a slightly better score if a gale of wind had not threatened to remove the mobile whip. I am always amazed at the perseverance of DX stations when trying to copy my QRP sigs...***GM4HQF.*** A lot of fun and very good propagation. Not easy to be QRV with low power on 160 in downtown Bogota, but fine with the slopers on 80 and vertical on 40... ***HK3JBR (F2JD).*** My first SOAB CQ WW DX from a multiplier place. Fantastic. Lot of problems with thunderstorm and antennas, but I am happy. Looking forward Y2K... ***IH9P (OK1FUA).***

What a blast! Missed one zone on 10m for a WAZ in a weekend. I operated only few hours with an MP without filtering. Let's figure what I heard with a 500 Hz stock filter only!...***IKØHBN.*** It was wonderful because it was my first WW!...***IN3NOR.*** Murphy visited me and jammed my computer hard disk. Has anyone tried magic keys "CTRL + ALT + DEL" before saving log? It's a terrible experience... ***IV3TQE***. Great fun as always and this year a better score. We lost one PC in our network Sunday afternoon and suffered some interstation QRM despite fitting Dunestars. We liked the condx and had a better setup and sharper operators than in previous years. Watch us in 2000! Planning has now started. My 47th birthday was on the Sunday of the test and everyone stopped sending when the XYL of SV5TH presented me with a birthday cake. Very nice...***J45T (G4OBK for J45T).*** The propagation on 28 MHz band was very good in this contest. I enjoyed so much...***JA1XRH.*** With our location (middle of Tokyo), bands were noisy especially in low bands. And our antennas for low bands were mainly DP, so operating low bands was tough for us...***JA1ZLO.*** Surprised to be called by A61AJ on 160m during working W6/7 hours! Also great to be called by zone 14 (three DLs) on 160m! The first night on 40/160m was awesome, but the second day was worse. Glad to make my best WW CW score...***JA8RWU.*** I enjoyed this contest very much for stable condx on 21MHz band long time. I wish to get more points next year expecting more sunspot numbers... ***JH3AIU.*** The score is increased little bits more than last year. It's my record. I could not QRV on 160 meter due to the trouble. The condx on 40m is very good for me... ***JH4ADK.*** I had only 2-hour sleep and few rest. So I had done my best and marked new JA record in Single Op category...***JH4UYB.***

With a lot of pleasure I have participated in this competition, the 1999 CQ WW DX CW Contest. I have enjoyed it as always, now with a new experience of competing in the category of QRP and many desires to have a good and happy weekend and to greet to the excellent old and new CW operators that deck out this party. As always it happens, there was a lot of QRM of CB pirates angry, protesting the high CW activity! In this band (28 MHz) listen truck drivers from Argentina and bordering countries, with their colleagues, families, and friends, in the face of the easiness of the authorities. Could you help us, could the ARRL help in this problem? It is the same as drugs. I think it is an international problem. In spite of everything we had a great party, with many, many stations. Some alone listened, because with the impossible QRP to work them. My bilateral deafness of 90 % influences in the bad operation, for what I apologize to those I was not able to copy...***LU7EE.*** Had a blast, got a kick out of being called by 5A1A!...***KG4RF (K8RF).*** Most QSOs ever, most mults ever, biggest score ever. Wow! The only dark cloud was the lack of a decent opening to EU on 10m. At the top of the sunspot cycle we get our best score ever on 40!...***KL7Y.*** Didn't get some of the long path propagation that I heard other Caribbean stations taking advantage of on Friday night. Antennas needed to come down between phone and CW due to strange late season hurricane. Went into contest with objective of breaking 10m North American record. Mission accomplished but was also accomplished by several others. Good to get KP2A back on the air again...***KP2A (KW8N).*** This CQ WW CW was my first contest from SA. Good cndx, many stations on the band, but nobody answer my call. EU worked with USA and JA. USA and JA with EU. I feel like on VHF with QRPp... ***ZS5/LY2BBF.*** Very nice conditions on 10, even forget about 20m till sunday morning...***LY2IJ.***

This is my best result since I take part in CQ WW DX Contest. Practically all QSOs I made after my call. But 110 different countries is a good achievement for my small rig ...***LZ1AG.*** If some of the speed merchants slowed their callsigns down a bit they would be called by many more stations like myself who just could not copy at that speed. Thanks for organizing a fine contest...***MMØBQI.*** Only 13 hours on the air;, a lot of fun despite missing a lot of multipliers because of low power. Highlight was HC8N, really the loudest DX signal here. SU9ZZ called me and gave me a new one on 80!...***OE2LCM.*** My deepest respect to FK8HC and PYØZFO, who both kept waiting until the Europeans stopped QRMing and who pulled me into their logs! Also big thanks go to V73CW who called me on 15m. I had a QSO with Mike at R1AND days before the contest and he said he would look for me. Guess what? He really made it! All in all a fantastic contest with many surprises and good participation. It really seems to me that CQ WW contests make the earth tremble year after year!...***OE5OHO.*** Trashed score target...got 15% more than anticipated. Thanks for the last contest this millennium!...***OHØV (OH6LI).*** We missed zone 29 for the super jackpot—a historical 4-band WAZ in CQ WW CW. I think now OH1F and OH2U are holding the record of 3-band WAZs in CQ WW CW. On 80m only WAE country worked was 4U1VIC, so this makes our effort as the first Scandinavian 5BDXCC multi-single log ever. Well, sad to us but OH7M beat us. Also SK3W is very close (9.3M) so we are anxious to see what is the new final Scandinavian record...***OH1F.*** The demanded encore of the Paksalo Philharmonics (aka OH2U) was yet another blast! Some musicians were on their pre-scheduled solo tours, but by tuning all the instruments to the limit the rest of the orchestra went through the main concert of the millennium with style, and the audience was given a thrilling show with the climax of making the long-played European Record performed by LX7A to become history. The old millennium was closed as the millennium of the Paksalo Philharmonics—the OH's to you!...***OH2U.***

1998's 20% score penalty made me want to improve my logging and give it another try. Tried to pay special care in not logging any uncertain QSOs, gave my callsign more often in S&P, etc. Let's see how it turns out this year. Condx vy good and my strategy worked fine. Got good night sleep before the start so had no problems in staying awake for full 48 hours. Only last 2 hours were difficult, but nothing compared to 1998...***OH5LF.*** Excellent conditions and excellent contest. No low-rate (OH-scale) hours in principle. But the operator was not capable to keep up any rates after 40 hours nor was he wise enough to take a nap at that point. You all who are like-minded know how it is. The sado-masochistic pleasure, which is hard to explain to non-believer...why even try it. Thanks everyone for short but nice QSOs. Special thanks to station host Pete, OH5NQ. Also thanks to Peter and Axel, OH5NW, for mental support when visiting me during the test. Too bad you could not help much. Some things a man just has to do alone...***OH5NQ (OH6EI).*** It was nice to work CQ WW CW from home QTH after three years! A lot of multipliers were on the air and together with good conditions it was nice to find them!...***OH6YF.*** Quite good conditions even from north. Missed some (easy) EU multipliers. Spent much time on searching multipliers and that resulted in less QSOs than last year but I have never got so many mults before and the score seems to be much better. Hope 2000 gives even more improvement...***OH8LAE.*** Good propagation again—all 40 zones worked! Never thought that it possible to complete WAZ, DXCC, WAC and maybe WAS, WAE, etc., in one contest!...***OK1KT.*** It was hard to rotate the antennas in heavy snow and wind. More than 1m of the snow everywhere; 55m high tower became more than 10cm frosted...***OK1RP.*** My greatest contest ever. Super condx and very nice activity. Thanks to *CQ* for making this show possible. See you next year for sure...***OZ1AA.***

First contest with over a 1000 QSOs. The new antenna seems to be working alright now. Also was signalled quite a lot on the cluster, so if it is not acceptable, please scratch it out, but I think no penalty should be attached to this correction—only if I take it out myself and the operation appears to be legit then I am doing wrong to somebody else... ***PAØMIR.*** It was a propagation-wise interesting weekend. The band was open to every part of the world. Even at local noon I could hear K8PO working a ZL3ATA with very strong signals. Sad thing was that I missed two potential 7 MHz new ones: heard T32PO with good signals but I could not break the North American pile-up; the same thing with JD1BIC/JD1. No activity heard from zones 30 and 38. Hope they will be around next year...***PA3AAV.*** As I remember well I sent in a check log for the 1998 CW contest. But I discovered in the October *CQ* issue the log was changed into a "normal" contest log. Thanks to whoever did this. I hate the after-contest logging work. This year I used the "Superduper" program and again had a lot of fun. Thanks again for a superb contest, and will be around next year! Also think some very loud ops do need a hearing aid ...***PA3BFH.*** Will be back again...***RA3XA.*** CQ WW DX CW is the most wonderful great competition. 6D2X had heavy pile-up of USA on 80m we could not break through; next time please try operate for EU sometimes. The result raised quickly at the last hours: 10 minute of operation on USA

(Continued on page 117)

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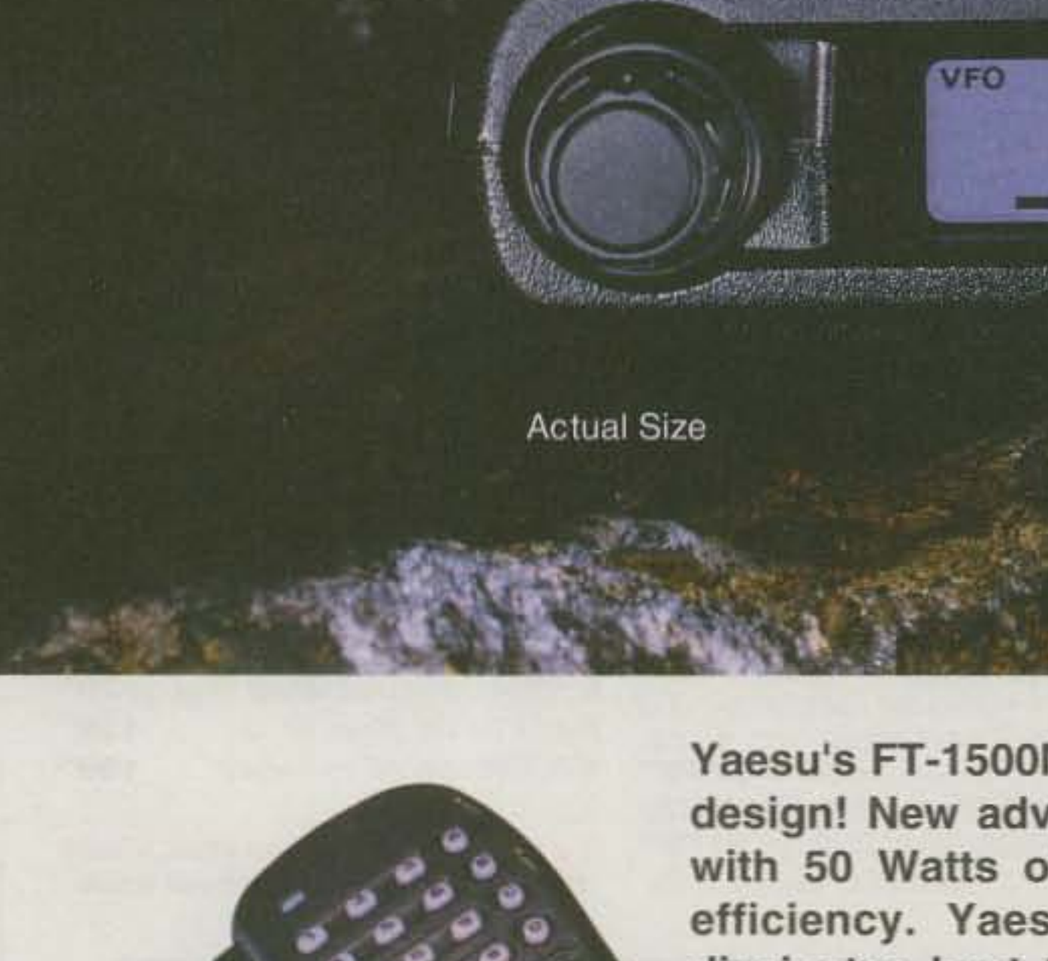

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We continue our series on the radio effects of the relationship between the Sun and the Earth with this guide to interpreting and using the most common measures of geomagnetic activity.

Measuring Geomagnetic "Weather"

BY KEN NEUBECK,* WB2AMU

A huge solar flare of a magnitude that comes along only once or twice in a solar cycle was bad news for HF operators last July 14, but it was great news for VHFers. The geomagnetic storm that resulted when the particles hurled off the Sun by the flare reached the Earth virtually shut down long-distance HF propagation via the *F2* layer of the ionosphere. However, it also produced intense auroras that provided tremendous openings on VHF, permitting 2 meter contacts 500– 600 miles away (see last month's "VHF-Plus" column for details).

In the first two parts of this series ("Uncle Sol's Solar Wind and the Earth's Magnificent Magnetosphere," August and September *CQ*) my colleague Karl Thurber, W8FX, explained in detail the relationship between the Sun and the Earth, and how particles carried by the solar wind interact with Earth's magnetosphere and result in either enhanced or depressed radio propagation conditions. How can you tell what the geomagnetic "weather" is going to be? Should you plan to look for DX on 20 meters? Or to explore the possibilities of auroral communication on 6 and 2?

The most commonly available source of geomagnetic weather reports is WWV (2.5, 5, 10, 15, and 20 MHz), which in addition to its time signals, also provides hourly Geophysical Alert Broadcasts. The measurements used in the WWV broadcasts include the "*K*-index" and the "*A*-index." Understanding and using these measurements is the topic of this article.

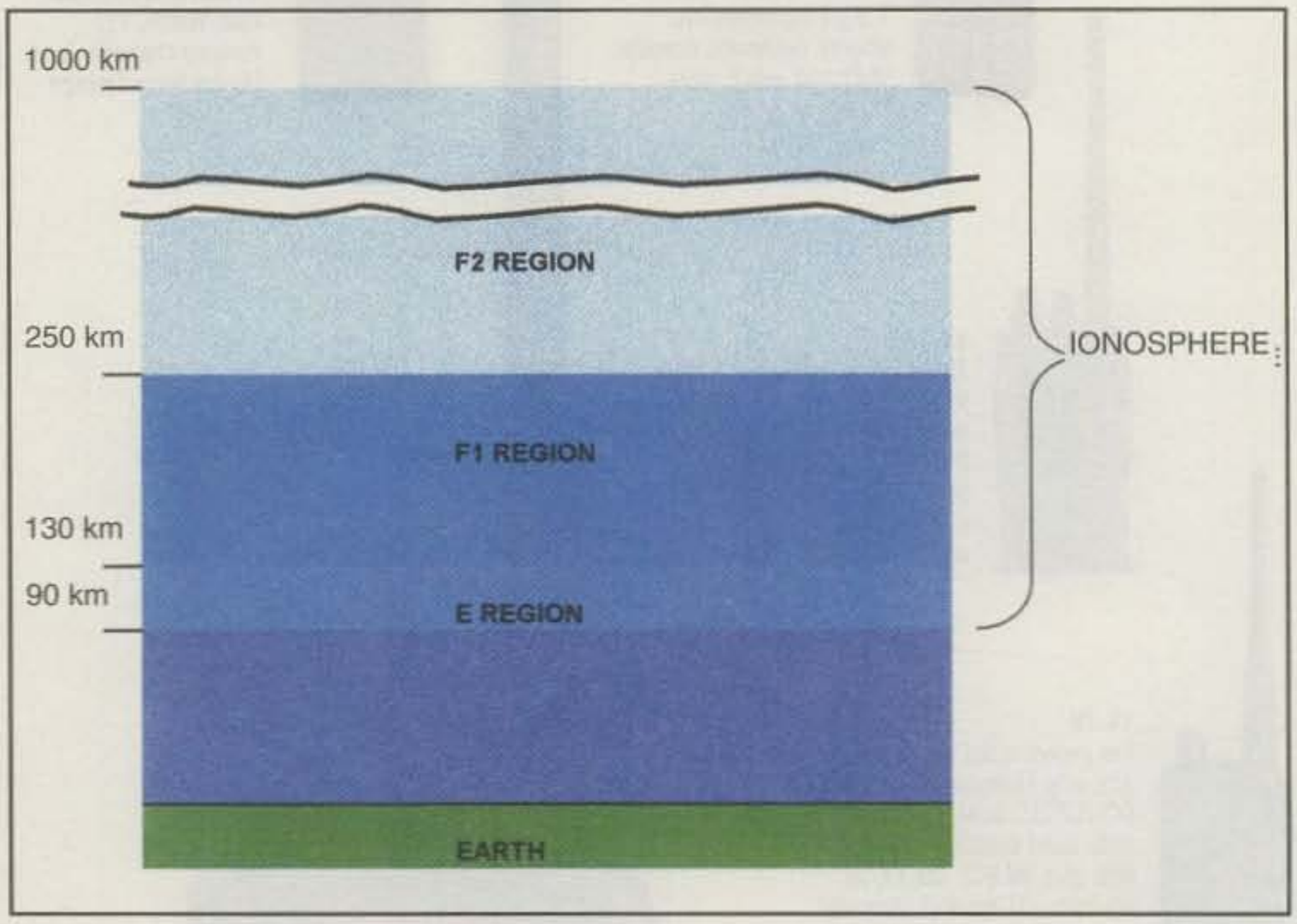

Fig. 1– The basic layers of the ionosphere that permit long-distance radio communication. The D region (below the E region) also affects communications, but only in terms of absorbing waves at certain frequencies and preventing their refraction by higher layers.

Measuring Geomagnetic Activity

Before we get into the numbers, let's

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[1]In addition to the NOAA reference in the first paragraph of this article, a similar handbook is issued by NOAA called User's Guide to the Preliminary Report and Forecast of Solar Geophysical Data *(issued July 1995). It is also quite useful.*

Kp Index Values and Associated Effects

Kp index value	Geomagnetic Descriptor	Average occurrence per solar cycle	Typical effects on radio frequency communications
9	Extreme storm	4 days	HF propagation impossible, VHF aurora propagation
8	Severe	60 days	Sporadic HF propagation, VHF aurora propagation
7	Strong	130 days	Sporadic HF communications, VHF aurora propagation
6	Moderate	360 days	HF propagation fades at high frequency, some VHF aurora
5	Minor storm	900 days	short periods of VHF aurora propagation possible
4	Active	>1000 days	Generally no effect on HF propagation
3	Active	> 10,000 days	Generally no effect on HF propagation
2	Unsettled	> 10,000 days	Generally no effect on HF propagation
1	Quiet	> 10,000 days	Generally no effect on HF propagation
0	Quiet	> 10,000 days	Generally no effect on HF propagation

Table I– The K_p, or planetary K, index and what the numbers generally mean. In addition, the table shows how often these conditions typically occur during an 11-year solar cycle and their most common effects on radio communication.

K- to A-index Conversion

K	0	1	2	3	4	5	6	7	8	9
A	0	3	7	15	27	48	80	140	240	400

Table II– Equivalent K- and A-index readings. For example, if there were eight individual A values of 1 for each of the three-hour periods during a 24-hour day, this would yield 8 times 3 = 24 for the daily a_p value.

look at why it is important for hams to be aware of these measures of geomagnetic activity. The first paragraph of the NOAA (National Oceanic and Atmospheric Administration) "User Guide for Geophysical Alert Broadcasts"[1] states it best: "Different types of solar terrestrial (Sun–Earth) interactions influence the state of the Earth's upper atmosphere, changing its properties and its ability to support the propagation of radio waves."

As hams, we know that electromagnetic radiation from the Sun is strong enough to cause photo-ionization of atmospheric constituents at high altitudes (such as oxygen and nitrogen) in the region known as the ionosphere. This ionization results in various forms of sky wave propagation. The ionosphere consists of different regions, including the *D* region, the *E* region, and the *F1* and *F2* regions, and all are affected in different ways by the radiation from the Sun. Refer to fig. 1 for a pictorial description of the different ionospheric regions, or layers.

Certain levels of geomagnetic activity can either adversely affect or enhance particular propagation modes that rely on activity in the ionosphere for some of the higher HF bands, along with the 6 and 2 meter bands on VHF. Of interest in this area is the occurrence of *geomagnetic storms* that can affect both the *E* and *F* layers of the ionosphere. High geomagnetic activity that results in storms can be a double-edged sword: It can really impede normal HF sky-wave communications such as *F2*-layer propagation, yet it can enhance certain *E*-layer-related propagation such as aurora on the VHF bands. During the high sunspot count years, it pays for hams to be increasingly aware of geomagnetic activity and how it is measured so that listening can be concentrated in the right area—mid HF, high HF, or VHF.

Derivation of the *K*-index and the *A*-index

The two most useful measures of geomagnetic activity for hams are the *K-index* and the *A-index*. The *K*-index is a quasi-logarithmic index that describes geomagnetic activity, ranging from 0 (very quiet conditions) to as high as 9 (highly disturbed conditions). It is based on readings taken over a three-hour period and is derived from *the most disturbed horizontal component of the local geomagnetic field* during that time. See Table I for a detailed description of the different *K* readings and their relative occurrence during a sunspot cycle.

At any particular station that measures *K*, there are eight values of *K* that are collected daily and are available by the internet and announced by WWV at 18 minutes after each hour. The eight daily *K* indices can be combined into one number representing the overall activity for the day by converting each *K* value into an individual a_k*-index* using the conversion table, Table II. The eight a_k indices are then averaged to yield the daily *A*-index value.

There are tables more detailed than Table II that are used to calculate precise *A* values. For example, there are finer divisions for each number—i.e., for the *K* value of 5, there is a set of values, 5-, 5o, and 5+, which corresponds to *A* values of 39, 48, and 56. Thus, if one has access to the finer precision *K* values, a more precise value of A can be computed. However, for most amateur-related-related purposes, the basic numbers are sufficient.

K can be measured at stations such as the NOAA station in Boulder, Colorado, while *A* can be measured at stations in Fredericksburg, Virginia for middle latitude, and in College, Alaska for

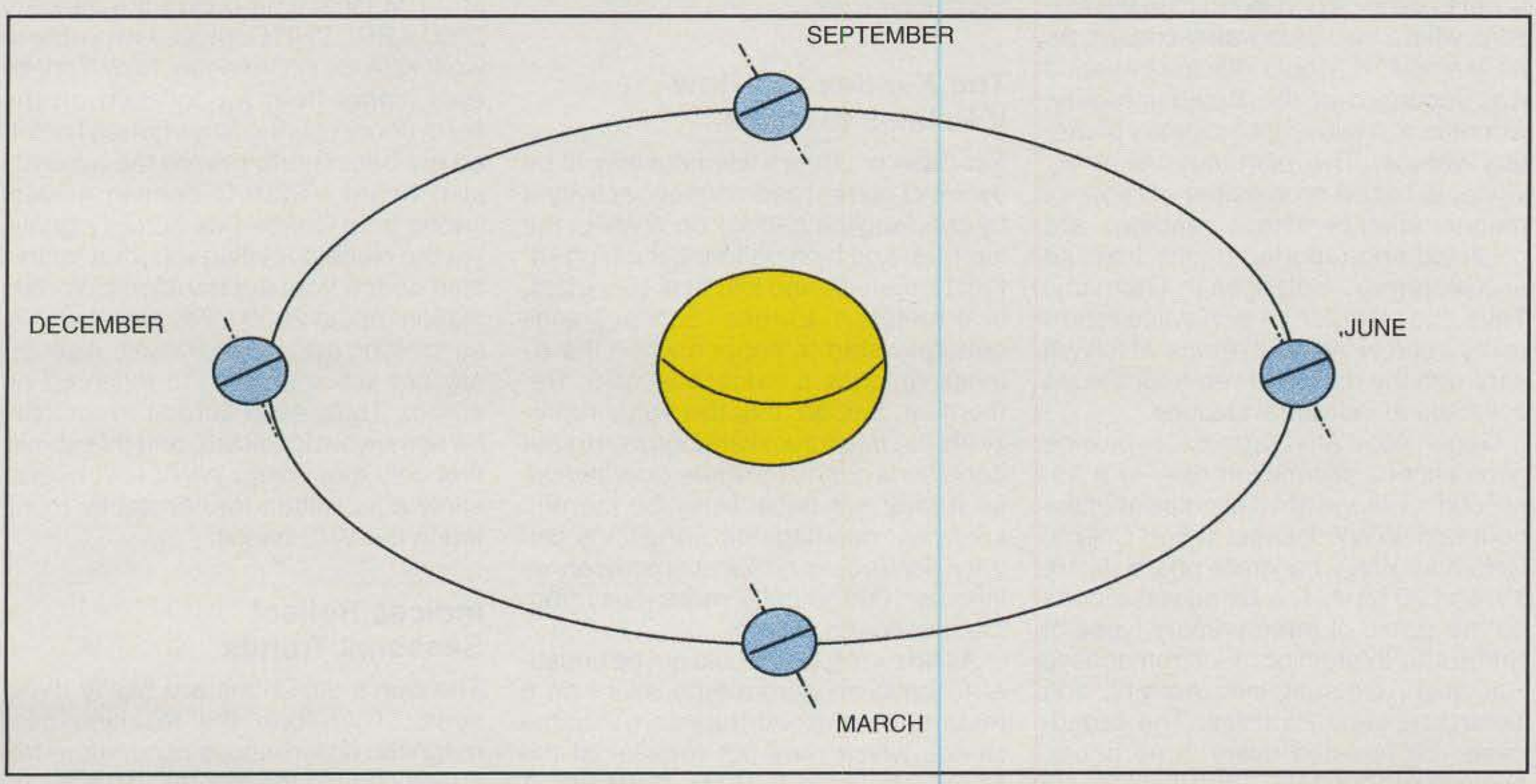

Fig. 2– This figure shows how the Earth's 23.5° tilt on its axis changes its orientation toward the Sun in different seasons.

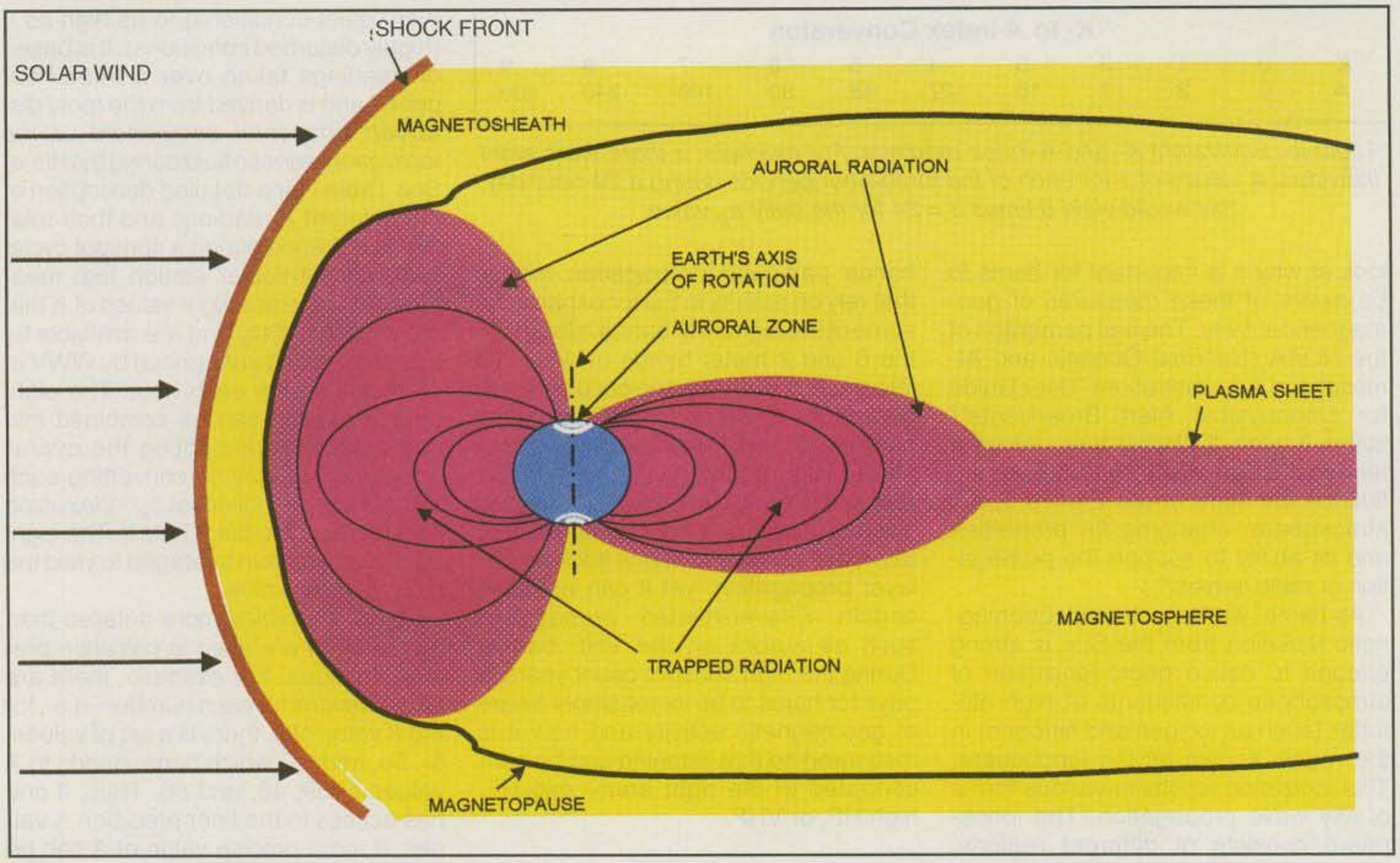

Fig. 3– In this figure, the plane of the Earth's axis is consistent with the position that it is in during the fall and spring equinoxes. The Earth's position at these times is more favorable for receiving solar precipitation that will affect the auroral zones that surround the north and south geomagnetic poles. At other times of the year the axis of the Earth is not in the same plane (it has a 23.5° tilt toward or away from the Sun) and is thus in a less favorable position for solar precipitation entering the auroral zones.

high latitude. It is common to add a subscript to either *A* or *K* to indicate the stations where the value was recorded. As an example, K_b would indicate the value was recorded at the Boulder facility, whereas a *p* subscript indicates planetary values. The *planetary A,* or A_p value, is based on a global network of magnetometers whose readings are collected and reported by the Institute für Geophysik, Göttingen in Germany. Thus, the planetary *A* or *K* value represents a sort of overall average which will vary with the daily or three-hour values collected at individual stations.

Geophysical Alert Broadcasts provide geomagnetic information daily in a 45-second message at 18 minutes after the hour from WWV, located in Fort Collins, Colorado. WWV transmits on 2.5, 5, 10, 15, and 20 MHz. The broadcast reports on the states of three primary types of Sun-Earth interaction: Electromagnetic Radiation, Geomagnetic Activity, and Solar Energetic Particles. The broadcasts are updated every three hours, beginning at 0000 UTC, and they include the latest solar-terrestrial indices which reflect the disturbance level of the Sun-Earth interaction.

The *K*-index and How It Relates to Hams

For radio amateurs, the best way to be aware of current geomagnetic activity is by checking the *K*-index on WWV or the internet, and by monitoring the high HF (10/12 meters) and low VHF (6 meters, or 4 meters in Europe) bands. Things generally start to happen when the *K*-index reaches a value of 4 or 5. Remember, though, that this value represents the *maximum variation from quiet conditions during the three-hour period*, so it may not necessarily be current. Likewise, geomagnetic conditions can vary depending on locations, even as little as 1000 to 2000 miles away from the monitoring station.

As an example, it would not be unusual to have an aurora-type event on 6 meters in the northeastern United States which may not register at the NOAA station in Boulder, Colorado. A case in point was when I observed an auroral opening developing on 6 meters at 3 PM local time during the January 2000 ARRL VHF Contest. I was able to work K2AXX in Geneseo, New York by *backscatter* from my location on the north shore of Long Island when I pointed my beam north toward the aurora. I also heard VE2DFO coming in very strong from Quebec via aurora signals, yet the highest *K* value reported for this time period from the Boulder, Colorado station (about 2000 miles away) was 4, suggesting active conditions but generally not active enough to touch off an aurora. Thus, even auroral events can be somewhat localized, and this shows that only monitoring WWV isn't necessarily a substitute for constantly monitoring the VHF bands.

Indices Reflect Seasonal Trends

The Sun's emissions are highly directional. Therefore, the resulting geomagnetic disturbances occur more frequently during the months of the spring and fall equinoxes as the Earth is in the

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INPUT VOLTAGE: 115 VAC 50/60HZ OR 220 VAC 50/60HZ SWITCH SELECTABLE

OUTPUT VOLTAGE: 13.8VDC

AVAILABLE WITH THE FOLLOWING APPROVALS: UL, CUL, CE, TUV.

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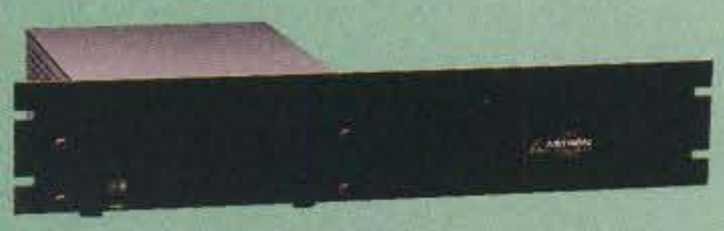
DESKTOP SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SS-10	7	10	1⅛ x 6 x 9	3.2
SS-12	10	12	1⅜ x 6 x 9	3.4
SS-18	15	18	1⅜ x 6 x 9	3.6
SS-25	20	25	2⅞ x 7 x 9⅜	4.2
SS-30	25	30	3¾ x 7 x 9⅝	5.0

MODEL SS-25M

DESKTOP SWITCHING POWER SUPPLIES WITH VOLT AND AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SS-25M*	20	25	2⅞ x 7 x 9⅜	4.2
SS-30M*	25	30	3¾ x 7 x 9⅝	5.0



MODEL SRM-30

RACKMOUNT SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25	20	25	3½ x 19 x 9⅜	6.5
SRM-30	25	30	3½ x 19 x 9⅜	7.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M	20	25	3½ x 19 x 9⅜	6.5
SRM-30M	25	30	3½ x 19 x 9⅜	7.0

MODEL SRM-30M-2

2 ea SWITCHING POWER SUPPLIES ON ONE RACK PANEL

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25-2	20	25	3½ x 19 x 9⅜	10.5
SRM-30-2	25	30	3½ x 19 x 9⅜	11.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M-2	20	25	3½ x 19 x 9⅜	10.5
SRM-30M-2	25	30	3½ x 19 x 9⅜	11.0

MODEL SS-12SM/GTX

MODEL SS-10EFJ-98

CUSTOM POWER SUPPLIES FOR RADIOS BELOW

EF JOHNSON AVENGER GX-MC41
EF JOHNSON AVENGER GX-MC42
EF JOHNSON GT-ML81
EF JOHNSON GT-ML83
EF JOHNSON 9800 SERIES
GE MARC SERIES
GE MONOGRAM SERIES & MAXON SM-4000 SERIES
ICOM IC-F11020 & IC-F2020
KENWOOD TK760, 762, 840, 860, 940, 941
KENWOOD TK760H, 762H
MOTOROLA LOW POWER SM50, SM120, & GTX
MOTOROLA HIGH POWER SM50, SM120, & GTX
MOTOROLA RADIUS & GM 300
MOTOROLA RADIUS & GM 300
MOTOROLA RADIUS & GM 300
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SS-18GX
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SS-18EFJ
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SS-12MC
SS-10MG, SS-12MG
SS-101F, SS-121F
SS-10TK
SS-12TK OR SS-18TK
SS-10SM/GTX
SS-10SM/GTX, SS-12SM/GTX, SS-18SM/GTX
SS-10RA
SS-12RA
SS-18RA
SS-10SMU, SS-12SMU, SS-18SMU
SS-10V, SS-12V, SS-18V

*ICS – Intermittent Communication Service

Number of Days During Which *K* (Planetary Values) > 6+ (*A* > 94)
1990–1999

	J	F	M	A	M	J	J	A	S	O	N	D	Total
1990	0	1	3	2	2	2	1	2	1	0	1	0	15
1991	0	0	4	2	1	9	3	5	4	3	5	0	36
1992	0	6	0	0	2	2	0	1	4	0	1	1	17
1993	0	1	3	1	0	1	0	1	1	2	1	2	13
1994	0	4	1	3	3	0	0	0	0	2	1	0	14
1995	1	0	0	1	1	0	0	0	1	2	1	0	7
1996	0	0	0	1	0	0	0	0	0	1	0	0	2
1997	0	1	0	1	2	0	0	0	1	2	2	0	9
1998	0	0	1	0	3	0	0	2	1	1	1	0	9
1999	1	1	1	1	0	0	1	0	1	1	1	0	8
Total	**2**	**14**	**13**	**12**	**14**	**14**	**5**	**11**	**14**	**14**	**14**	**3**	**130**

Table III– A 10-year view of the number of days each month when the planetary K-index was 6 or higher or the planetary A-index was 94 or higher. This indicates at least a moderate geomagnetic storm (see Table I) and signals the likelihood of an auroral opening as a result.

best position to receive these emissions from the Sun. Basically, the Earth is rotating in the same two-dimensional plane around the three-dimensional object of the Sun. At the summer solstice the Northern Hemisphere is leaning toward the Sun at nearly a 23.5° slant from the Earth's axis. During the winter solstice the Northern Hemisphere is leaning *away* at the same 23.5° slant. During the equinox months, the Earth's plane of rotation is parallel to the Sun's (see fig. 2).

The way that the solar wind works is a much more complicated process than one might think. Solar precipitation does not directly collide with the Earth in the same way that sunlight falls on our planet. Instead, it follows a complicated pattern where there is an extended plasma trail behind the Earth as well as unique auroral radiation patterns surrounding areas of the Earth as shown in fig. 3 and discussed in detail by W8FX in the first two parts of this series.

As a result of this unique pattern and the axis orientation of the Earth, aurora openings are more common during the equinox months of the year. However, this is not to say that geomagnetic storms affecting the Earth cannot happen during other months of the year. Throughout the years, from my location on Long Island I have observed some good 6 meter aurora openings during May, July, and August. In fact, by examining the planetary *A*-index data, one can see that summertime aurora events are not that unusual, particularly during the high sunspot years. Table III shows the number of days per month—a 10 year span from 1990 through 1999—when the *A*-index equaled or exceeded 94 (*K* value of 6+) during one of the eight three-hour intervals. When values reach this level, aurora events are quite possible on 10 and 6 meters. By examining the table, one can also see that there is occasional activity during the equinox months of March, April, September, and October throughout the length of the solar cycle. Aurora events can still occur during the quieter years of the cycle, although during these years there are typically fewer than ten days of high activity for the year.

Another interesting pattern in the numbers shown in Table III is that virtually no storm-level geomagnetic activity is seen during the winter months of December and January at any point in the ten years of data presented. In the meantime, activity during the summer months from May through August may be observed during the high sunspot count years (1990 through 1992 were high count years). Thus, for this current sunspot cycle, it is quite possible that aurora and maybe even some TEP will be seen during the summer months on 6 meters during the high count years of 2000, 2001, and 2002. In fact, there were some excellent auroral openings this past summer. Those who monitor the band on a daily basis may be rewarded when such events occur.

What is TEP? Along with increased auroral openings associated with high levels of geomagnetic activity, there is an apparent relationship between subsequent occurrences of *transequatorial propagation* and occasionally *F2*-related openings on the higher HF bands and 6 meters. TEP provides openings between locations on either side of and roughly equidistant from the

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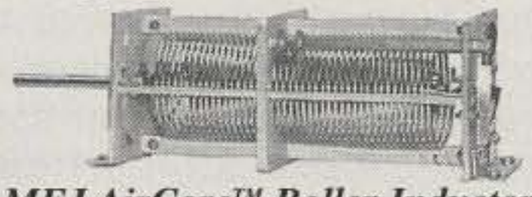

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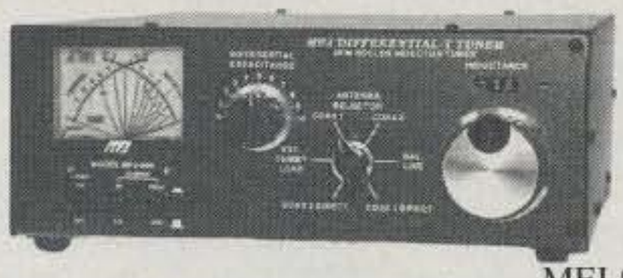

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Two knob tuning (differential capacitor and *AirCore*™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross-Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. 10¾Wx4½Hx15 in.

MFJ-962D *compact* Tuner for Amps

MFJ-962D
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A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! *AirCore*™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. 10¾x4½x10⅞ in.

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Superb *AirCore*™ Roller Inductor tuning. Covers *6 Meters* thru 160 Meters! 300 Watts PEP SSB. *Active* true peak reading lighted Cross-Needle SWR Wattmeter, *QRM-Free PreTune*™, antenna switch, dummy load, 4:1 balun, Lexan front panel. 3½Hx10½Wx9½D inches.

MFJ-949E *deluxe* 300 Watt Tuner

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MFJ-941E *super value* Tuner

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MFJ-971 *portable/QRP* Tuner

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Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6x6½x2½ inches.

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Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2x3x4 in.

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MFJ-906 has lighted Cross-Needle SWR/Wattmeter, bypass switch. Handles 100 W FM, 200W SSB. **MFJ-903, $49.95**, Like MFJ-906, less SWR/Wattmeter, bypass switch.

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geomagnetic equator (which doesn't always follow the geographic equator). High geomagnetic activity can increase the ionization in the *F* layer over the geomagnetic equator, resulting in TEP-type openings. For example, during the last sunspot cycle on November 2 and 8, 1991, I was able to work into Argentina from my QTH on Long Island on 6 meters via a combination of sporadic-*E* plus TEP. In both cases there were very high levels of geomagnetic activity during the 24-hour period *preceding* the opening. As an example, on November 1st there was a 12-hour period when the K_p ranged from 7 to 8 (major storm levels), and on November 8 and 9 there was an 18-hour period of *K* values ranging from 7 to 9.

The same trend is continuing with this cycle, as I was able to work into Argentina on May 24 at 2215 Z after *K* values of 7 and 6 were reached the night before. Thus, not only should the 6 meter band be monitored for auroral openings after a geomagnetic storm occurs, it also should be checked for TEP and north-south *F2* activity. My best experience with this was a midnight 6 meter opening into Colombia and Panama from my QTH shortly after an intense aurora opening (see the June 2000 "VHF-Plus" column). As discussed briefly in my February 2000 *CQ* article, "Explanations for Unusual Propagation" and in detail in my "Mix and Match Propagation" article in the February 1999 issue of *CQ VHF*, the path from the northeast U.S. into Argentina on 6 meters can only be a TEP plus a sporadic-*E* combination. The knowledge gained by these observations for the most part has shown that any long-range path on 6 where the signal crosses the geomagnetic equator, such as the northeast U.S. into Argentina, pretty much has to involve TEP and not double-hop *F2* skip.

What About HF?

K values reaching 4 and higher generally will mean adverse conditions to normal *F2* propagation on the HF bands. Thus, one can be talking with many stations around the world on one day on 10 meters, and the next day not a single signal can be heard if geomagnetic activity has increased to levels reaching a *K* value of 4 and higher

Geomagnetic activity tracks very well with the sunspot cycle. There is much more activity during the higher sunspot count years and as a consequence, more aurora events. However, even during the quiet sunspot count years there is still some auroral activity with some fairly intense openings that can be observed on 6 meters. Refer to the April 2000 issue of *CQ* for further reading on aurora propagation.

For this cycle many hams are keeping an eye out on the daily *K* and *A* values as part of their wait for the big one or two geomagnetic events to hit Earth (*we already had one "big one" in July —ed.*). Again, WWV and the internet are excellent sources, in addition to band monitoring. There are several very good websites that contain this information. First and foremost is the NOAA Space Environment Center's "Space Weather Now" page at <http://www.sec.noaa.gov/SWN/>. Another good website is <http://www.spaceweather.com>, and one of my favorites is the DX Listener's Club site from Norway <http://www.dxlc.com/solar/indices.html>. This site also contains daily sunspot count and solar flux values. Be aware that the data is current up to the previous day, so monitoring of the WWV broadcasts or checking the NOAA site is still a good idea to keep abreast of current geomagnetic conditions.

I hope this information, in addition to what you've learned about the Sun-Earth relationship in W8FX's articles, will help you learn how to interpret what you hear (or don't hear) on various bands and DXing possibilities that may open up on one band when another is closed due to high geomagnetic activity. The final segment of this series is a look at NOAA's new Space Weather Scales, explained by *The New Shortwave Propagation Handbook* co-author Ted Cohen, N4XX (see page 65). ■

Math's Notes

What's New And How To Use It

BY IRWIN MATH, WA2NDM

Chips, Op-Amps, and PC Boards

You will recall that several months ago we discussed the "Quick Radio™" low-cost receiver chips from Micrel, which generated lots of mail on the subject. Since then I found out that Micrel has published a small booklet called the "RF Receiver/Demodulator Handbook." The booklet discusses these chips in detail, as well as providing very useful data on antennas that can be interfaced directly with them. You can request a copy through their website at <http://www.micrel.com>. Receiver enthusiasts will find it most useful. Also, at the same website you will find all kinds of information regarding the applications of the radio-on-a-chip IC.

While we are on the subject of RF receivers, I would like to make you aware of a fairly new high-speed op-amp from Burr Brown that can be used to implement all kinds of peripheral high-speed circuits...

While we are on the subject of RF receivers, I would like to make you aware of a fairly new high-speed op-amp from Burr Brown that can be used to implement all kinds of peripheral high-speed circuits (such as IF amplifiers) in the same frequency range. This device is the OPA685, which is a 1.2 GHz current mode op-amp. The chip offers a 1200 MHz unit gain and guarantees a bandwidth of greater than 400 MHz at voltage gains of 10 with a dual ±5 volt supply, although the unit can be used with a single 5 volt supply (bandwidth drops to 600 MHz).

The unit comes in an SO-8 or even smaller SOT23-6 package and is rated for operation from –40° to +85° C. It draws 12.9 ma of operating current and can provide up to 6 volts pp into a 100 ohm load with dual supplies, or 2 volts with a single supply. In addition to normal op-amp inputs and outputs, the unit also has a disable pin which can be used to turn off the unit to conserve power. Best of all is the cost is only $1.89 each in quantities of 1000, with somewhat higher cost for single units. A comprehensive data sheet with many applications is available from the manufacturer at <http://www.burr-brown.com>. By the way, duals are also available.

For those of you who design, or would like to design, your own custom printed circuit boards, I would like to introduce you to a company that will allow you to produce absolutely professional results. The company is Cadsoft Computer.

For those of you who design, or would like to design, your own custom printed circuit boards, I would like to introduce you to a company that will allow you to produce absolutely professional results. The company is Cadsoft Computer; their website is <cadsoftusa.com>. If you go to this website, you will find their Eagle™ software. This is a full-feature schematic capture/printed-circuit-board program that will allow you to draw a formal schematic as well as produce a direct-linked printed circuit board from it. Not only can you draw schematics and lay out printed circuit boards, you can switch from one to the other at the click of a mouse while you are working. The components on the printed circuit board are "rubber banded" so that the schematic design is transferred to the board error free.

The program is very easy to learn, and the results are truly professional. The only limitations of the free download are that the maximum board size cannot exceed 3.2" × 4", the board can only be two-sided, and the application cannot be commercial. For the experimenter it is perfect, and yes, through-hole and surface-mount parts are supported. In fact, almost any component style you can imagine is provided. For the odd-balls, you can even design your own "footprint."

The "free" limitations should suffice for most projects you build, but if larger boards are required, a small fee of $49 will get you the "Lite" version, and $199 will get you the unlimited package. These costs are trivial compare to what you can do with this package. I personally have tried the free version and it works like a charm. It took me about two to three hours to make my first board, and it was perfect. I also produced professional, industry-standard Gerber output files for the PC fabrication house, which they indicated were fine. You just won't believe how easy it was to learn, so go for it! The price certainly is right.

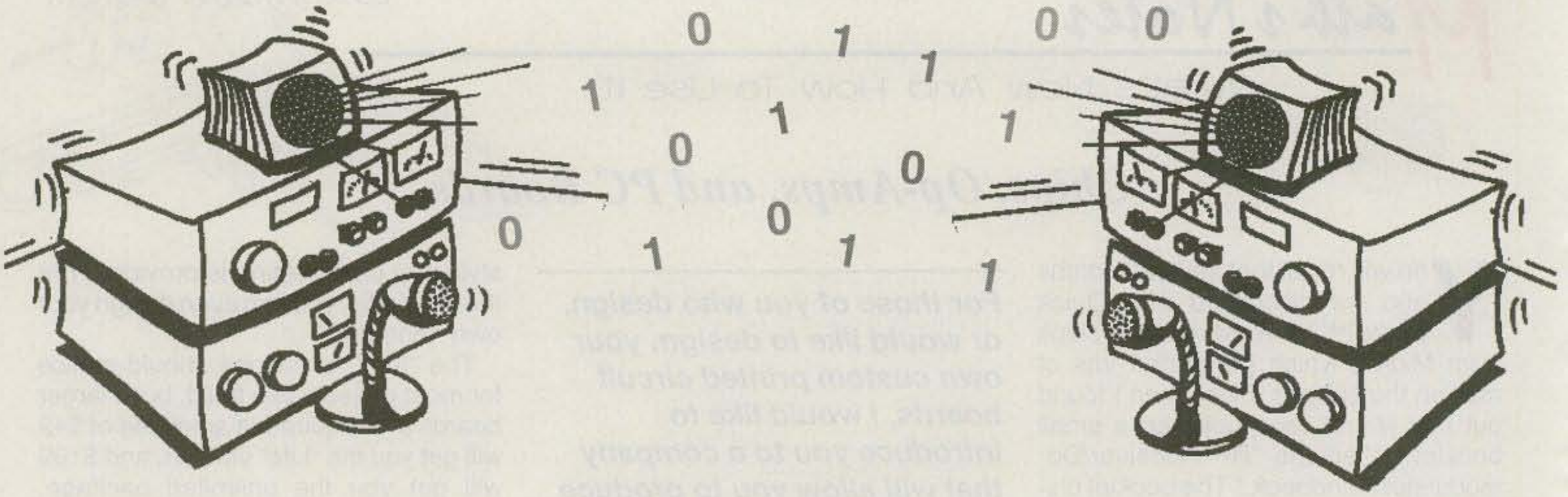
Once you make the artwork for your board, there is another source I have discovered that will fabricate the board for you directly from the Gerber files you create with the Eagle™ software. The company is Bay Area Circuits, located in the San Francisco area. Their website is <bacircuits.com>. They offer a "Quick Turn" service that will deliver a complete double-sided PC board (no silk screen or solder mask, but with plated through holes) to you by Federal Express in 24 hours. Although this service costs $295, the size that they will process is such that you probably can obtain a number of boards. For the 3.2" × 4" limitation of the Eagle™ software you probably can get 10 to 12 boards, all neatly trimmed and drilled. For quick-turnaround club projects this service simply can't be beat.

The person to contact at Bay Area Circuits is Raul Garcia, 650-367-8444. He will be more than willing to discuss your requirements. Tell him I sent you. Although this service is really designed for industrial prototype applications, the company will support the experimenter, so don't hesitate to give Raul a call. Also, I personally have tried Bay Area Circuits, and the boards did come in 24 hours as promised. The quality was indistinguishable from that of professional boards obtained from other sources.

That about covers it for this month. See you in November!

73, Irwin, WA2NDM

c/o CQ magazine



Our September issue devoted quite a bit of attention to comments by the FCC's Dale Hatfield, WØIFO, on what hams need to do to stay relevant in the 21st century. One of his recommendations was for hams to take the lead in developing so-called Software Defined Radios (SDRs). Now, WA6ITF peers into the future of a ham radio in which SDRs are as common as synthesized radios are today.

The Coming Revolution in Ham Radio Part I

BY BILL PASTERNAK,* WA6ITF

You may not be aware of it, but a revolution is about to take place in ham radio. A digital revolution. Not just in signal processing, but in the whole way we approach communications in our hobby realm.

I'll start by suggesting that after you finish reading the next several pages, you tear them out, put them in a sealed envelope, and store the envelope in a safe place. Ten years from now, as you sit in front of your 100% digital Software Defined Radio(SDR) amateur station with antenna mounted RF to digital converter, you will see how rudimentary these initial thoughts probably are. Be that as it may, the digital revolution is here, and its day-to-day technological advances wait for no one. Look at that Pentium 133 or 166 MHz PC that you purchased only four or five years ago, thinking it would be the last computer you'd ever need. Slow, isn't it, as you compare it to last year's 440 MHz or the latest 1 GHz Pentium 3 processors? Folks, that's where ham radio is headed, so get ready to rock.

Based on my experience in the broadcast industry, it is my prediction that the next generation of ham radio and ham radio equipment will be totally different from what you are using today. These will be the so-called Software Defined Radios now in early stages of development. Because they are software defined, they will be able to operate in any mode and on any frequency, based on what they hear and the signal to which they are responding. As a result, the concept of "modes" as we know them today will begin to blur as everything we do becomes a part of the digital domain.

I am not just talking in terms of the rudimentary Digital Signal Processing (DSP) in use in some "high-end" HF transceivers. This technology might best be considered as the "spark-gap era" of digital. Rather, I am referring to every mode we use today, be it CW, SSB, FM, SSTV, AMTOR, or even basic packet. All will become bitstreams that *represent* what we now do as we become a part of the digital world.

Get Ready to Accept A New Digital Future

Let's start by saying this is not going to be a technical dissertation. At times I may use terms with which you are not familiar—at least not yet. I will try to explain them in laymen's terms, but I want to keep this at a level every ham can read and understand. That includes those whose interest is "operational" rather than technical. So please do not complain if what follows seems simplistic to you. If it is, my only advice is to skip to another article of interest to you in this month's edition of this magazine. Those of you who want to learn

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the basics and peer a few years ahead, read on!

In many ways, every bit of ham radio communication eventually will become some form of packetized digital communications. It will not matter whether it is Morse, text, or audio. It all will be converted to data, transmitted as data, and received as data. It then will feed a D-A (Digital to Analog) converter so it can interface with the only analog device in the system—the operator.

From Spark to CW to...

By way of example, here is one possible (if not probable) scenario for Morse code that could be a standard in a few years. In the digital world you may find yourself actually using a modified form of MCW (modulated CW) wherein your keying will generate an audio tone somewhere between 400 Hz and 1 kHz. Many SSB transceivers use this technology today. However, here is where we depart from the analog world. In digital, this "tone" will be run through an A-D (Analog to Digital) converter which will in turn generate a bitstream (complete with your personal identifier) that's the digital equivalent. This bitstream is what will be transmitted. The "smart" receiver at the other end of the path will recognize the fact that it is hearing digitized Morse, decode your identification, and probably give you the option of converting the bitstream Morse to traditional audio Morse, displaying the Morse converted to text on a monitor, or putting the letters together into words which will be enunciated by your receiver!

Inventing the DAR

Another scenario: Let's suppose your favorite pastime is erecting and maintaining repeaters. Right now you approach your local coordinator, hopefully get a channel pair, find some surplus commercial two-way radio gear, and convert it for the ham bands. This is the way it has been since the beginning of FM repeaters, and after 50 years not much has changed. A decade from now, however, you may not find a single FM repeater on the air. They won't be going away; they will be going digital. More correctly, they will become *digitized audio* (packetized) *repeaters.* That's a mouthful, so let's coin a brand new ham radio acronym right now—DARs (Digital Audio Repeaters).

The funny thing is that the basic technology needed for a DAR has existed for the better part of two decades. It's called the Compact Disk, or CD. The "information" on a CD is nothing more than audio that has been sampled and digitized as a series of "1" and "0" numbers. The higher the sample rates, the better the fidelity (to a point).

Recording a CD is not much different than the digital Morse system we noted above. Your "talent" stands in front of a microphone (analog device) that feeds into a low-noise analog preamplifier to an A-D converter. The now digitized audio, which is called a bitstream, is fed to a digital audio mixing console where it is combined with other sounds that have been digitized. The output levels of each bitstream are adjusted to the desired level, and the combined signal is output to some form of digital recording device, such as a DAT (Digital Audio Tape) recorder. Once digitized, the material is nothing more than a new bitstream made up of all the other bitstreams that have been put together in the digital mixing console. Without getting into the minutia of the technology, that recording is used to make the CDs you buy at your favorite store.

What if that DAT recorder was replaced by a transmitter? If it were an FM transmitter, you would wind up with a series of pulses representing the audio rate of the ones and zeros. Your "next generation" mobile rig or HT will contain a D-A converter that will function much like a CD player. The CD player uses a coherent light beam (laser) to read the information on the CD disk and convert it to audio. Your radio will convert a digitized radio frequency signal to analog audio, and it all probably will happen inside a 50 cent Integrated Circuit chip! The output of this reconstituted bitstream will go to an audio amplifier, then to a speaker and to your ear. When it's your turn to transmit, you will reverse the data path.

The World of Broadcasting vs. The New World of Ham Radio

Think that will be hard to do? Let me tell you what we are doing right now in the world of digital broadcast television and show how it could apply to ham radio.

You most likely have heard that broadcasting is beginning its conversion from analog to digital television transmission. One of the most important aspects of digital television is giving every TV station the option to transmit either a single "High Definition" digital TV signal or several "Standard Definition" pictures in the same 6 MHz wide channel. The term coined to describe the latter is "Multicasting." Without getting super technical, Multicasting depends on several factors that permit several multiplexed digital signals to be transmitted at the same time in almost the same spectrum (more on this later) without interfering with each other. So if you are now watching analog Channel 7, when that channel goes 100% digital and you purchase a digital TV receiver expecting to find every station looking like the 16 × 9 aspect-ratio screen at your local movie house, you may be very disappointed. What you most likely will find is Channel 7 transmitting four or five separate "digital channels" with picture definition not much better than what you see today on that $149.95 NTSC (standard US analog TV) receiver you bought at the local discount house (see note 1).

Let's apply this spectrum-sharing concept to ham radio and DARs. If we set up a D-A converter that samples analog audio and converts it to a digital bitstream with the equivalent of a ±5 kHz deviation factor, that signal will fit in the current space occupied by any properly set up analog FM repeater. Let's face it: Not counting vestigial sidebands, 5 kHz is 5 kHz, be it analog or digital. In the digital world, however, we have a signal that is either "full on" or "full off" with nothing in between.

Now let's suppose that we take that time when one digital signal is "full off" to insert other data that is "full on." You probably will say that the new "full on" data will interfere with the first data that is "full off," or at 0. It would if your receiver was looking at all signals. However, your receiver more than likely will be looking for a specific bitstream ID representing the party with whom you wish to talk. This is because his transceiver will transmit a unique "digital ID" or "word" that in effect says, "Hey, it's me, Bill, WA6ITF." Once you acknowledge that you are talking to my unique "digital ID," your receiver will ignore all other IDs unless you instruct it to do otherwise. (This is essentially the same thing that happens in packet radio; once you're connected to a specific station, your TNC ignores all other received signals.) The term used to describe this kind of sharing is "multiplexing" or "MUX" for short (see note 2).

Now think in terms of adding some form of high-speed processing, allowing an infinite number of separate conversations to use the "full off" time of any number of other digital signals to transmit a "full on" bit of data. To the ear listening on an analog receiver, the channel would sound like a constant buzzing of bees. However, to a microprocessor-controlled digital receiver it would be an easy chore to separate "QSO A" from "QSO B" and "QSO C," etc. As long as there was space for a data burst, several distinct digitized conversations could take place on the same RF channel pair without one QSO knowing that the other was taking place.

Compression and Ham Radio Standards

It all sounds very simple, but the actual systems will be very complex. This is because the laws of physics take hold and permit you to shoe-horn in just so much data to so much bandwidth. Unfortunately, the amount of data vs. the amount of time and space available to transmit that data might not be enough to permit more than one or two QSOs to take place on any given channel pair. The solution is two words: "Digital Compression."

At the outset, let's make it clear that we are not talking about analog audio

compression, which is used to make ones signal "sound louder." Overly simplified and applied to this topic, in the digital transmission arena compression refers to transmitting only what data is necessary to permit intelligent communications. More important is *not* transmitting data that holds no intrinsic value to the communication. This is accomplished by using a "compression algorithm," which is nothing more than a complex mathematical formula. In essence, it is rudimentary artificial intelligence that looks at the content of your transmission, sees what you are trying to say and how you are enunciating it, and then permits only a certain percentage of that material to pass on to the transmitter. Put another way, it is a kind of "content limiter" that passes what is needed for clear nd fully intelligible communications and disposes of anything else.

There are numerous forms of audio and video compression schemes in use today in my area of endeavor—Motion JPEG, MPEG 1, and MPEG 2, and the list goes on and on. It almost seems as if a new system, or variation on a system, comes along every month or two. However, unlike ham radio, we in the broadcast community have a number of standards from which to choose. Amateur radio needs standards for the digital age, and it needs them quickly. How to accomplish this and how to ease the financial burden on "Joe Ham" will be covered in Part II.

Notes

1. Why not High Definition, you ask? The answer is simple—economics. The management of our fictitious Channel 7 and the managers of every real-world TV station know that there is more profit in Multicasting 3, 4, or 5 separate lower resolution programs than in one single high-definition transmission. If Channel 7 were divided into Channels 7-1, 7-2, 7-3, 7-4, etc., and each targeted a separate demographic audience, chances are a lot more commercial time would be sold, and it's those commercials that bring in the revenue.

2. Multiplexing several signals onto a single transmission media is nothing new. One of the biggest users of MUX for the past two decades has been the telephone company which uses the spaces between words and syllables in one conversation to insert information from other conversations. High-speed digital switching makes this possible.■

Washington Readout

Regulatory News In The World Of Amateur Radio

BY FREDERICK O. MAIA, W5YI

Amateur Radio's Most Common Questions

We get tons of questions about the hobby, especially from beginners who want to know about how to become a ham radio operator now that the top code speed exam has been reduced to 5 words per minute. Here are a few of the most common questions about what it takes to become an amateur radio operator and the entry-level rules that apply.

Q: Are there any age restrictions in amateur radio?

A: You can become an amateur radio operator at any age. If you can pass the license exams, you qualify for a ham license. The only age restriction in amateur radio applies to being a Volunteer Examiner. VEs must be at least 18 years old.

Q: Don't I have to be a U.S. citizen to apply for an FCC ham radio license?

A: No. Any non-citizen may elect to take the U.S. license examinations to qualify for an FCC-issued ham radio license.

Q: How hard is it to get an amateur radio license?

A: It's very easy. You have to pass one or more tests administered by Volunteer Examiners. Your local amateur radio club should be able to help you find examiners in your area. There are three written examination elements, one for each of the three (Technician, General, and Amateur Extra) license classes. Your written examination establishes your level of operational and technical ability in performing properly the duties of an amateur service licensee. Each written examination consists of a set of 35 or 50 multiple-choice questions. The passing rate is 75 percent. All possible questions are known and widely published. They are selected from a common question pool for each written examination element. Each pool contains at least ten times the number of questions required for a single examination.

You will be issued a license with a ten-year term and a station callsign appropriate for your class. Licensee information is retained in the licensee data base for two years beyond expiration to provide a grace period during which persons who unintentionally fail to renew their licenses have more time to do so.

Q: Don't I have to pass a Morse Code examination?

A: Not for the beginning, and most popular, Technician license. Due to international amateur radio regulations, however, the General and Amateur Extra Class license classes require passing a slow-speed telegraphy exam. The exam consists of being sent a short message typical of those transmitted by amateur stations. The test message contains the 26 letters of the alphabet, numerals 0–9, period, comma, question mark, slant mark, and prosigns AR, BT, and SK. You pass if you can copy 25 characters in a row or answer seven out of ten questions about the transmitted text. Punctuation, numerals, and prosigns count as two characters for scoring purposes.

Q: Are provisions made for disabled applicants to take the needed examinations?

A: Yes. The examiners are required to accommodate applicants with physical disabilities who may require a special examination procedure. They may, however, require you to provide a physician's certification indicating the nature of your disability before determining which, if any, special procedures must be used. For example, you can request that the written exam questions be dictated to you. There are also a number of ways that the Morse Code exam can be tailored to accommodate your disability.

Q: What determines the kind of station callsign I receive?

A: Callsigns are very important to ham operators. Most often it becomes their on-the-air name for life. Newly licensed amateurs always get a unique callsign assigned from the "Sequential Call Sign System" as part of processing their first license. The station is reassigned its same callsign upon renewal or name/address change, unless the licensee applies for a change. Each assigned callsign is sequentially selected from the alphabetized regional-group list for the licensee's operator class and mailing address. The mailing address must be one where the licensee can receive mail delivery by the United States Postal Service.

Each callsign has a one-letter (K, N, W) or two-letter prefix (AA–AL, KA–KZ, NA–NZ, WA–WZ) and a one-, two-, or three-letter suffix separated by a numeral (0–9) indicating the geographic region. Certain combinations of letters are not used. When the callsigns in any regional-group list are exhausted, the selection is made from the next lower group. Amateur Extra Class operators qualify for the shortest "Group A" callsigns. A new General Class licensee initially gets a "Group B" callsign. A Technician is initially issued a "Group D" cal sign, since all of the "Group C" calls have been assigned.

Q: I heard that I can choose my own callsign.

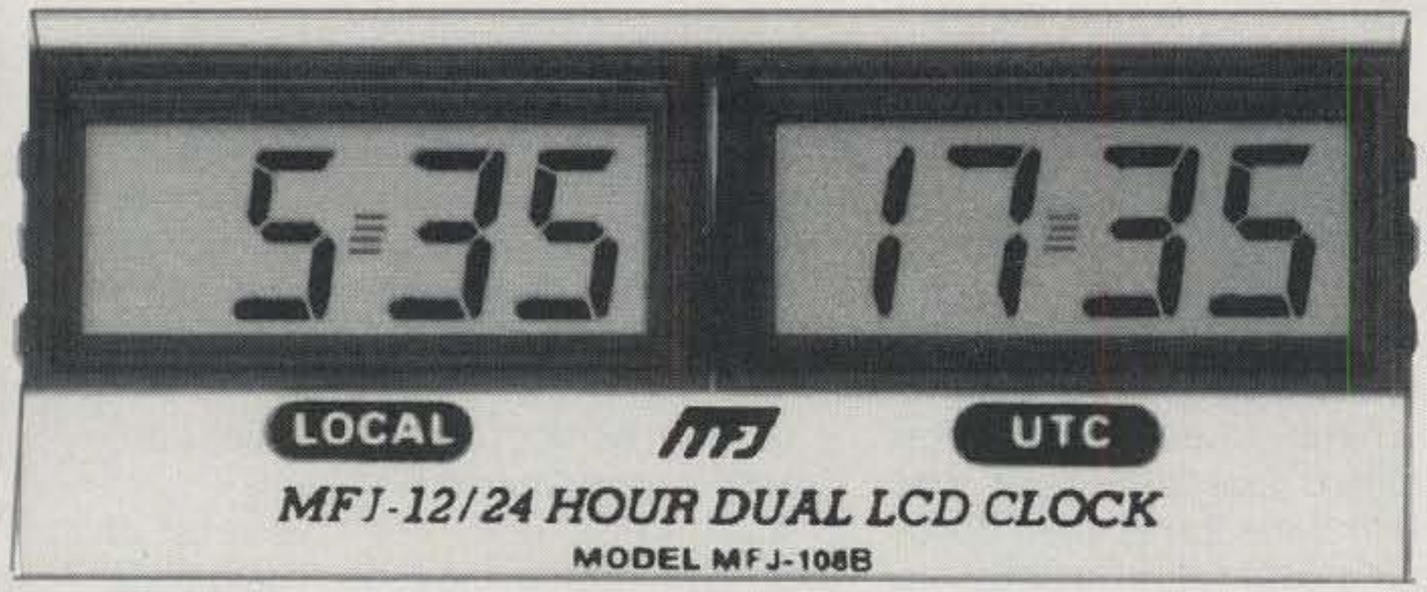
A: You are referring to the "Vanity Call Sign System." A vanity callsign may be requested for any individual or club station once a sequential callsign has been assigned. You can even get back a station callsign that you previously held or one belonging to a deceased relative if it has not been reassigned. Unlike "sequential" station callsigns which are free, there is a nominal charge for a vanity callsign. The vanity callsign is selected by the FCC from a list of callsigns requested by the station licensee. You may only select a callsign that is appropriate for your license class, and some callsigns are not available for assignment. There are many different eligibility rules that apply to the "Vanity Call Sign System." More information on how to get a vanity callsign can be found on the web at <http://www.fcc.gov/wtb/amateur/vanity.html>.

Q: I already hold an amateur radio license issued in [another country]. Can I operate my equipment in the United States without further licensing?

A: Yes, providing there is a reciprocal operating agreement between your country and the United States. A complete updated list of these countries can be found on the web at <http://www.fcc.gov/wtb/amateur/reciparr.html>. You

National Volunteer Examiner Coordinator, P.O. Box 565101, Dallas, TX 75356-5101 (telephone 817-461-6443)
e-mail: <w5yi@cq-amateur-radio.com>

MFJ 24/12 Hour Clocks



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Dual 24/12 hour LCD Clock

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plus s&h

MFJ-108B dual clock has separate 24 hour and 12 hour displays. Lets you read both UTC and local time simultaneously. Features huge high-contrast 5/8 inch LCD numerals that makes it easy to read across the room. Mounted in solid brushed aluminum frame with sloped face for easy viewing. Synchronizable to WWV for split-second timing. Quartz controlled for excellent accuracy. Long life battery included. 4½Wx1D x2H in. MFJ's famous *No Matter What*™ one year limited warranty. *$6 s&h.*

DXer's Wall Clocks

MFJ-125, $29.95. 12 inch DXer's Quartz wall clock gives 24 hour time plus more. Has three smaller independently settable dials for 12 hour time, day of week and date. No more day/date confusion when logging DX! Highly visible, easy-to-read dials! Has Seconds hand.

MFJ-115, $24.95. Set this 24 hour clock to UTC/ GMT and you can determine the time in any time zone of the world at any time of the day. Premier world cities encircle its colorful world map face to indicate time zone. 12 inch face is easy to see across room. Has Seconds hand.

MFJ-105C, $19.95. *World's most popular ham radio wall clock!* True 24 hour Quartz movement. Huge 12 inch black face with large white numerals give excellent visibility across room. Attractive gold colored hour, minute and seconds hands.

MFJ-126, $24.95. 12 hour Quartz movement gives 12 hour time on inner dial (for XYL) and 1200 to 2400 hour time on its outer dial (for you). Attractive clean, white face is highly visible. Real glass cover! Handsome hunter green trim. Has seconds hand.

Hi-Contrast LCD Clocks

MFJ-119B, $49.95. LCD Display 24/12 Hour Clock. Has *giant* see-across-the-shack 2¼ inch time digits. Digital calendar or clock modes. Displays inside temperature (F/C), relative humidity, month, date and day of week. Handsome hunter green and tan color. Wall mount. 8½x9 inches.

MFJ-118, $24.95. 24/12 hour clock has jumbo 1¼ inch LCD digits. Displays 24 or 12 hour time, year, month, date, and day of week. 100 year full calendar. Hang on wall or desk mount. 5¾Wx2½Hx½D in.

MFJ-107B, $9.95. 24 hour UTC Clock has large 5/8 inch LCD numerals. Synchronizable to WWV. Solid brushed aluminum frame lasts for years. Long life battery included. 2¼x1x2 in.

MFJ-112, $24.95. 24/12 Hour World Map LCD Clock displays time in *every time zone in the world*. Selected time zone flashes on LCD world map. Displays 24 or 12 hours, minutes, seconds, year, month, date, day, time zones, cities. Single button accesses pre-set second time zone. Alarms for two time zones. Adjusts for daylight savings time.

MFJ-152, $24.95. Read Indoor *and* Outdoor temperatures *and* 24/12 Hour time at-a-glance on huge 3/4 inch LCD digits! Choose F or C. Stores minimum and maximum temperature readings. Has backlight for in-the-dark viewing, outdoor temperature sensor with ten foot cable.

Bright LED Clocks

MFJ-114B, $59.95. Bright, GIANT 1.75 inch red LEDs are the biggest and brightest we've ever seen! 24 or 12 hour time with *seconds* digits. Easily seen 50 feet away -- even in the dark! 110 VAC. Great on your desk or mounted on the wall! 12½Wx4½ in.

MFJ-116, $14.95. Big bright 5/8 inch LED digits. 24 or 12 hour, 9 min. ID timer, battery back up. Black. 110VAC.
MFJ-116DC, $19.95. 12 VDC, plugs in cigarette lighter. *Great for motorhomes and truckers!* 12 hour only.

Monster Display *Atomic Clock* with PinPointAccuracy™

MFJ-120, $69.95. 24/12 hour *Atomic Clock* automatically receives WWVB for millisecond accuracy. Monster 2 inch LCD characters. Reads relative humidity and temperature (F or C). Has alarm. Attractive metallic copper color. Use on desk or mount on wall. Giant 8x10½Wx¾D inch showpiece.

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Tiny powerful MFJ *CyberEar*™ plugs in and loops over ear -- captures and amplifies sounds by 12 dB! Extends your hearing range, helps you hear every word at hamfests and club talks -- even if you're on the back row! Great for eyeball QSOs. 30 day money back if not absolutely delighted. *Not a hearing aid.*

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CIRCLE 126 ON READER SERVICE CARD

simply append your foreign callsign after the U.S. callsign district in which you are operating.

Q: Do I have to wait until I have received a copy of my license before I begin operating on the ham bands?

A: No. You can begin using your amateur radio equipment as soon as your license grant appears on the FCC data base. "QRZ.com" publishes a daily list of new hams at <http://www.qrz.com/new_hams.html>. You also can enter your name at <http://www.qrz.com/docs/names.html> to determine if the FCC has granted your license yet. You do not have to have the license document in your possession in order to operate an amateur station.

You may also query the FCC's Amateur Radio Service licensing information using the Universal Licensing System (ULS) application and license searches at <http://www.fcc.gov/wtb/uls/>. These searches allow the viewing of pending applications and granted license information.

Q: What communications cannot be made in the Amateur Radio Service?

A: The FCC Rules state that any type of amateur operator to amateur operator communications may be made on the ham bands as long as they are not specifically prohibited, transmitted for compensation, or done for the financial benefit of the amateur operator or his employer. These standards apply to all types of amateur communications. You may, however, notify other amateur operators of the availability for sale or trade of amateur apparatus normally used in an amateur station, provided that such activity is not conducted on a regular basis.

Q: What types of communications are "specifically prohibited"?

A: The FCC does not have a list of examples, but the rules specifically state that your amateur station may not transmit music, false or deceptive signals, obscene or indecent language, secret (concealed) messages, broadcast to the general public, or receive compensation for amateur communications. A school teacher may, however, receive compensation as an educator when an amateur station is used by that teacher as a part of classroom instruction.

Q: May I provide emergency amateur radio communications for the media—that is, to a radio or television station?

A: Amateur stations are prohibited from engaging in any form of broadcasting or in any activity related to program production or news gathering on amateur frequencies for broadcast purposes. The only exception is for emergency alerts which may be provided by amateur stations to broadcasters for dissemination to the public where no other means of communication is reasonably available before or at the time of the event.

Q: What types of two-way communications are amateur stations authorized to transmit?

A: You may engage in two-way communications with amateur stations located anywhere in the world as long as you are operating within the frequency and technical parameters of your license. Transmissions to a different country must be made in plain language and must be limited to technical and unimportant information. There are no "banned" countries. As a general rule, amateur stations may communicate with other FCC-regulated services and on any frequency when providing emergency "safety-of-life (or property)" communications and normal communications systems are not available.

Q: What types of one-way communi-

cations are amateur stations authorized to transmit?

A: Auxiliary, beacon, space, and stations in distress are specifically authorized to make certain one-way transmissions. Additionally, an amateur station may make brief transmissions necessary to make adjustments to the station or to establish two-way communications with other stations. Telecommand and telemetry to and from various radio-controlled devices are also authorized. Broadcasting to the general public is not permitted, but amateur stations may transmit Morse Code practice and disseminate amateur-radio-related information bulletins over amateur spectrum.

Q: Who gets to use a specific amateur radio frequency?

A: All station licensees and each control operator must cooperate in selecting transmitting channels and in making the most effective use of the amateur service frequencies. A specific transmitting frequency is not assigned for the exclusive use of any amateur station. You must not interfere with ongoing amateur communications in progress.

Q: May I give permission for an unlicensed person, such as my wife, to operate my amateur radio station?

A: Only amateur radio licensed (or authorized) persons may be the control operator of an amateur station. You may allow most unlicensed persons to speak or communicate over your station as long as you are there and operating the controls, but they may not "operate" the station, which is defined as being able to adjust the technical parameters of your transmitter. An appropriately licensed operator must always be present at the control point during amateur communications. You may not permit an unlicensed person to communicate over your station if they have been involved in serious prior enforcement proceedings.

Q: Do I have to abide by the various technical parameters authorized by my license when performing emergency communications?

A: Yes. The rules have been carefully developed through the rulemaking process to provide an amateur radio service which can respond to public service, emergency, and disaster communications needs. It would be illogical to abandon these rules during emergency communications, an event of the very type for which the rules were intended. There are two exceptions. An amateur station may use any means of radio communication at its disposal to provide essential safety-of-life communications when normal communication systems are not available. Also, an amateur station in distress may use any means at its disposal to attract attention, make known its condition and location, and obtain assistance. A sinking ship is a good example.

Q: Where can I find an online copy of the Amateur Radio Service rules and regulations?

A: The FCC's Rules for the Amateur Radio Services are published annually in the Code of Federal Regulations, Title 47, Telecommunication, Part 97. Since the rules are constantly being updated, the best place to get them is online from the W5YI or ARRL web sites located at <http://www.w5yi.org/Part97A.htm> or <http://www.arrl.org/field/regulations/news/part97/>. The Part 97 Rules listed at the FCC's web site have not been updated as of this writing.

That's it for now, but we will keep you posted with more questions and answers in future columns.

73, Fred, W5YI

The J-pole antenna uses a half-wave radiator fed by a quarter-wave matching stub and is very popular on the 2 meter band. K6MHE explores problems with the J-antenna and offers his solutions.

The Skeleton-Sleeve-Fed Monopole

BY DAN RICHARDSON,* K6MHE

The Skeleton-Sleeve-Fed Monopole (SSFM) is really a J-pole antenna with improved performance characteristics. This antenna has an excellent omnidirectional pattern, exhibits a good match to 50 ohm coax, and can be constructed in about an hour at a low cost and from easily obtainable materials.

The Problem of a Standard J-pole Antenna

The J-pole is an easy antenna to construct, and if certain precautions are followed, it provides good performance. However, the J-pole does not produce a true omnidirectional pattern due to radiation from the 1/4-wavelength stub (matching) section (see "The J-pole Revisited, " by K6MHE, *CQ*, March 1998).

J-poles usually are built using one of the two popular configurations shown in fig. 1—the shorted-base technique fed by open-wire feed lines, or the open-stub-fed antenna fed by coax. However, whichever arrangement (open or shorted base) is used, the J-pole's skewed omnidirectional pattern remains essentially the same.

The Solution

The directional pattern can be improved by modifying the 1/4-wave matching section. This technique entails replacement of the 1/4-wave element with a cylinder surrounding the radiator to form the 1/4-wave coaxial section shown in fig. 2. Although the antenna can no longer truly be called a J-pole, because it does not resemble the letter "J," it operates on the same theory as the J-pole, but with a true omnidirectional pattern.

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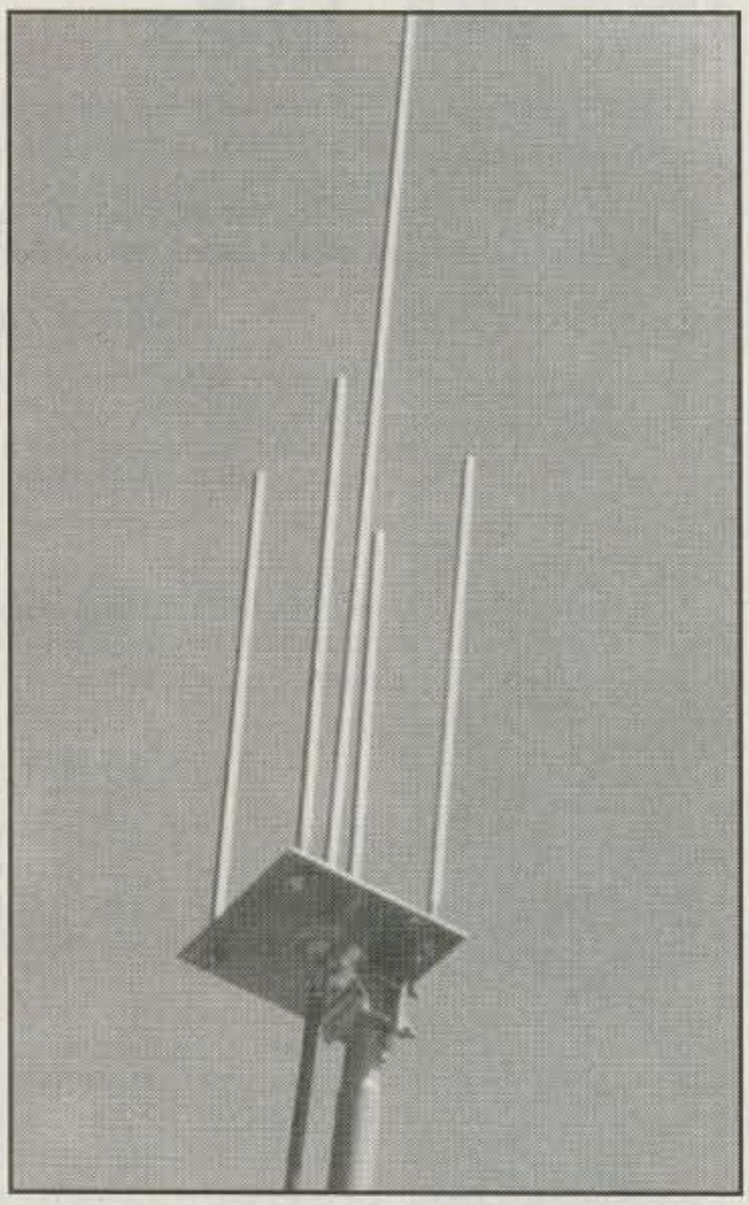


The Skeleton-Sleeve-Fed Monopole (SSFM) mounted to a vertical pole using the RadioShack mounting bracket.

One problem using this technique is the difficulty in constructing and mechanically supporting the outer sleeve segment. This problem can be overcome by replacing the solid outer sleeve with four vertical stubs. The result is the Skeleton-Sleeve-Fed Monopole depicted in fig. 3. The antenna's excellent omnidirectional performance can be seen in the computer-generated plots shown in fig. 4.

Construction

Fig. 5 shows the antenna assembly information and materials list. The layout and dimensions for the base mount-

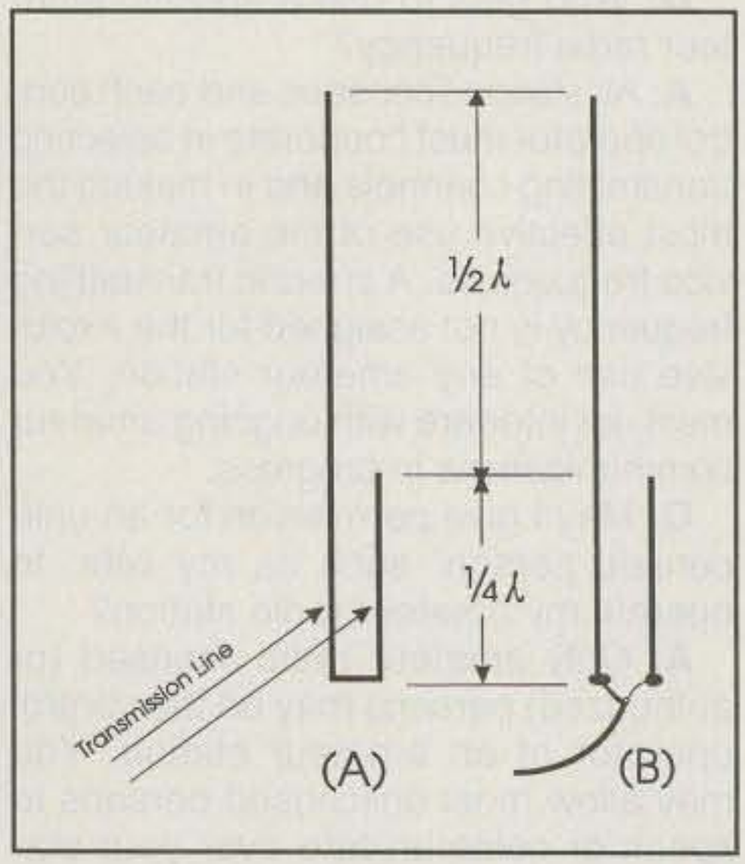


Fig. 1– Two possible J-pole configurations: (A) shorted base and (B) open base.

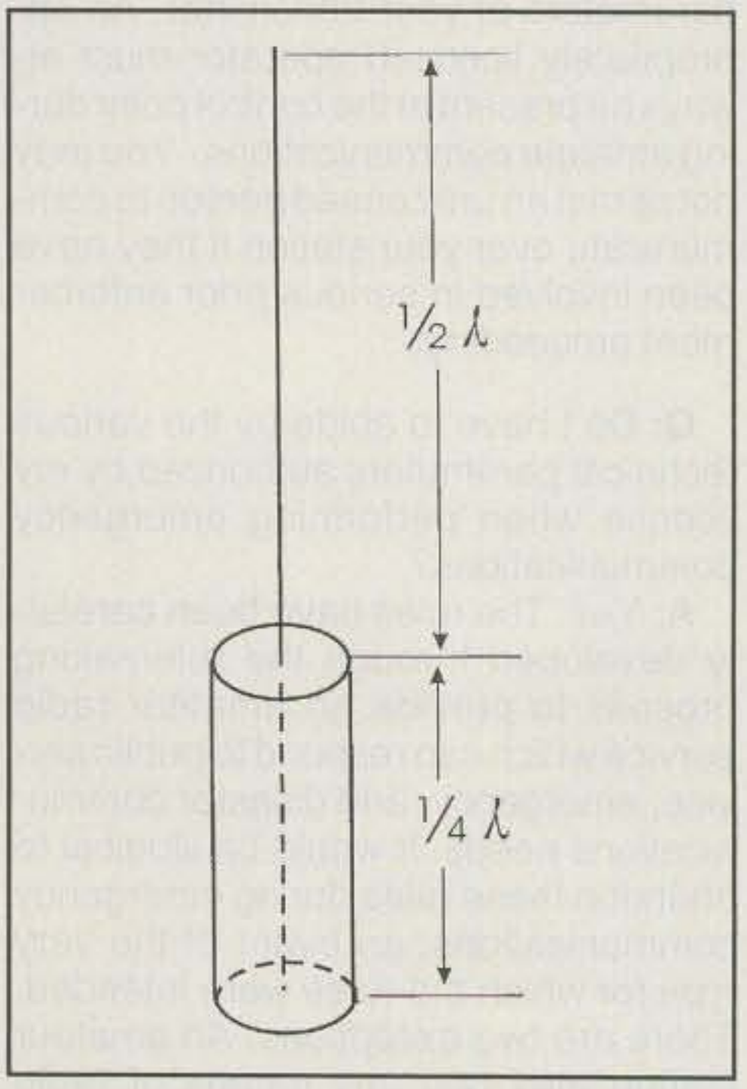


Fig. 2– A coaxial-sleeve-fed monopole.

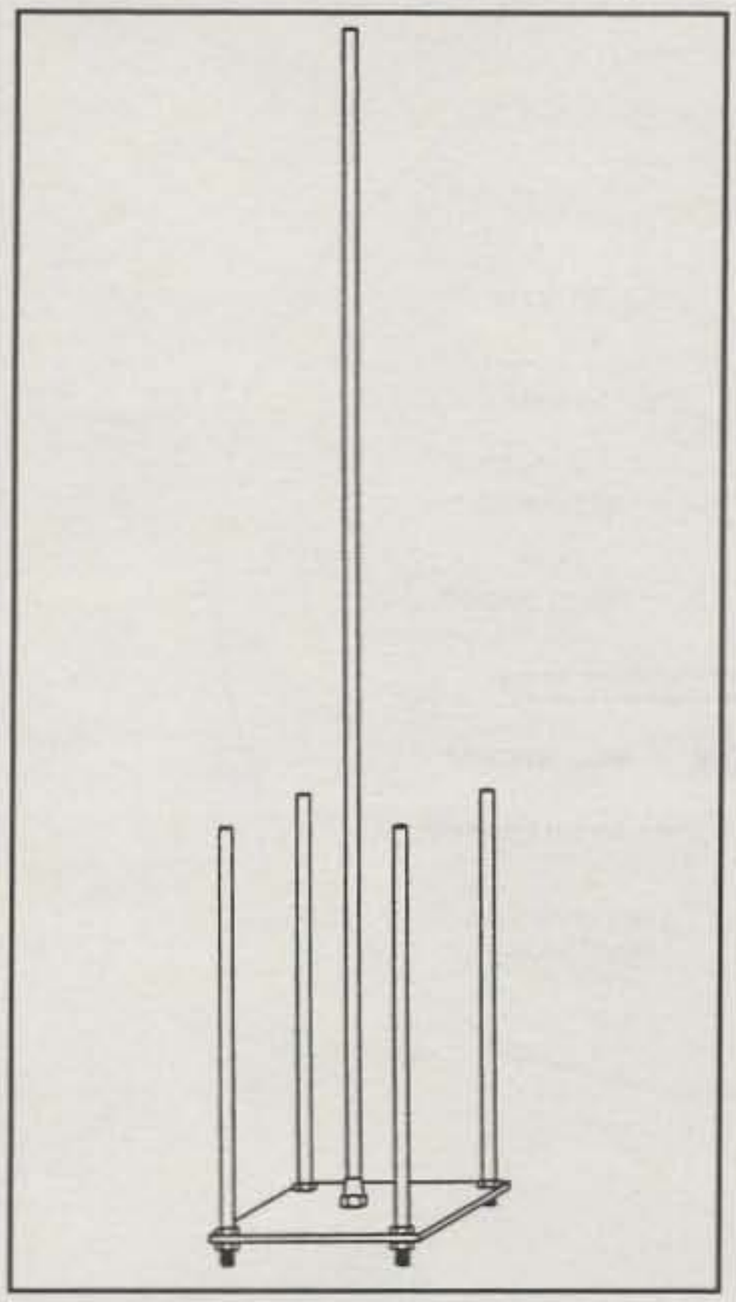


Fig. 3– The Skeleton-Sleeve-Fed Monopole.

ing plate (which was made from a scrap piece of 1/8 inch thick aluminum panel stock) are given in fig. 6. The total cost of the required materials was less than $30. The aluminum rod and stainless-steel hardware were acquired at my local home-supply store. The center element support and mounting bracket assembly is an inexpensive mobile antenna-mounting bracket obtained at RadioShack (catalog #21-937B).

With the exception of the hole diameters, the base-plate dimensions (fig. 6) are not critical. However, be sure to drill the five holes in the base plate perfectly vertical and maintain equal distances between the center-element mounting hole and each of the four stub-element mounting holes to retain good balance. Carefully cut threads into one end of each of the aluminum rods as shown in fig. 5. Keep the thread cutting die perpendicular to the rod when cutting the threads to assure that all of the elements are perpendicular after the antenna is assembled.

The 59 1/4 inch length given for the driven element in the materials list is correct. Attaching the antenna mounting bracket to this element adds the 1/2 inch required to yield the proper length (59 3/4 inches) of the radiating element.

Adjustment

If the antenna is built to the specifications shown in figs. 5 and 6, it should be resonant at approximately 146 MHz and should provide a good match to 50 ohm coax. The antenna measured less than 1.2:1 SWR at resonance (146 MHz) and not greater than 1.5:1 at the band edges. Calculated and measured SWR curves for the SSFM are shown in fig. 7.

The long 1 3/4 inch thread length on the 1/4-wave stub elements should provide enough range to adjust the antenna to resonance within the 2 meter band. In addition, the length of the 3/4-wavelength radiator element may also require adjustment. Remember, when building self-resonant antennas, making antenna elements slightly longer and then trimming them for the desired frequency is always good practice.

Installation Notes

The effect of common mode current on the transmission line can be very detrimental to any antenna's operation, especially at VHF/UHF frequencies. At

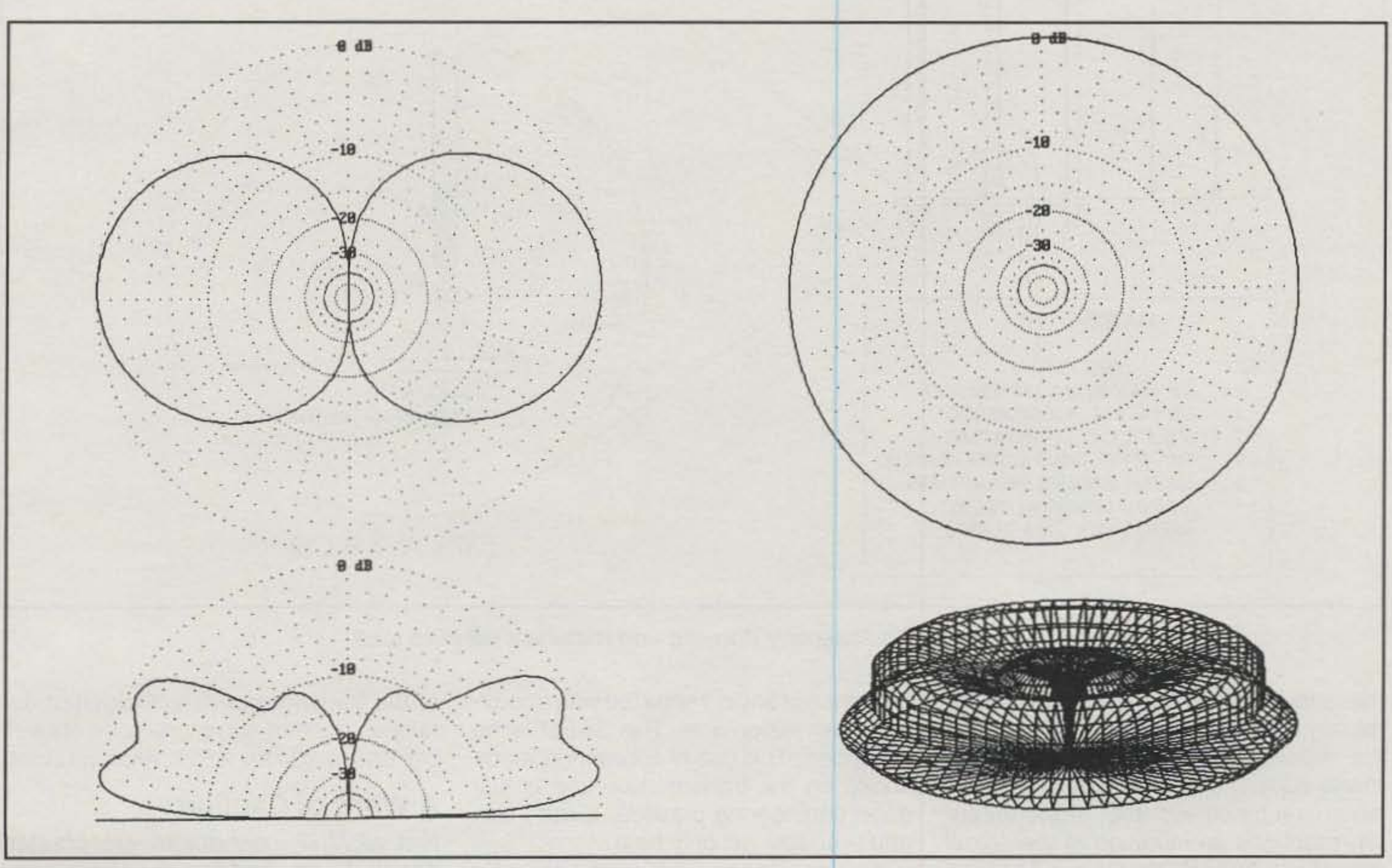
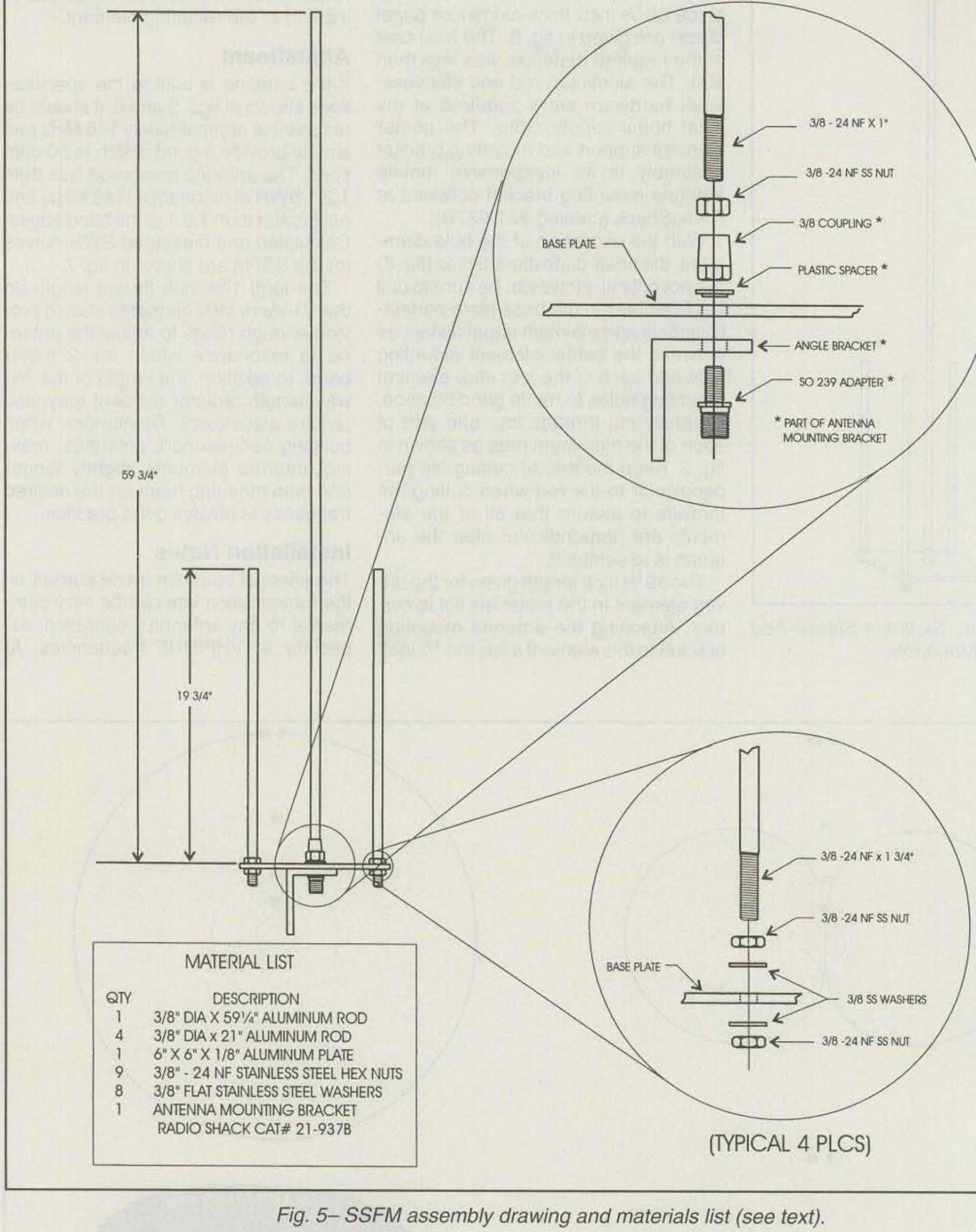


Fig. 4– Computer-generated plots for the SSFM. The upper two plots are free-space patterns, and the lower plots (elevation and 3-D) are above-average ground. Computer plots were produced using EZNEC antenna software (by Roy Lewallen, W7EL, P.O. Box 6658, Beaverton, OR 97007).



MATERIAL LIST

QTY	DESCRIPTION
1	3/8" DIA X 59¼" ALUMINUM ROD
4	3/8" DIA x 21" ALUMINUM ROD
1	6" X 6" X 1/8" ALUMINUM PLATE
9	3/8" - 24 NF STAINLESS STEEL HEX NUTS
8	3/8" FLAT STAINLESS STEEL WASHERS
1	ANTENNA MOUNTING BRACKET RADIO SHACK CAT# 21-937B

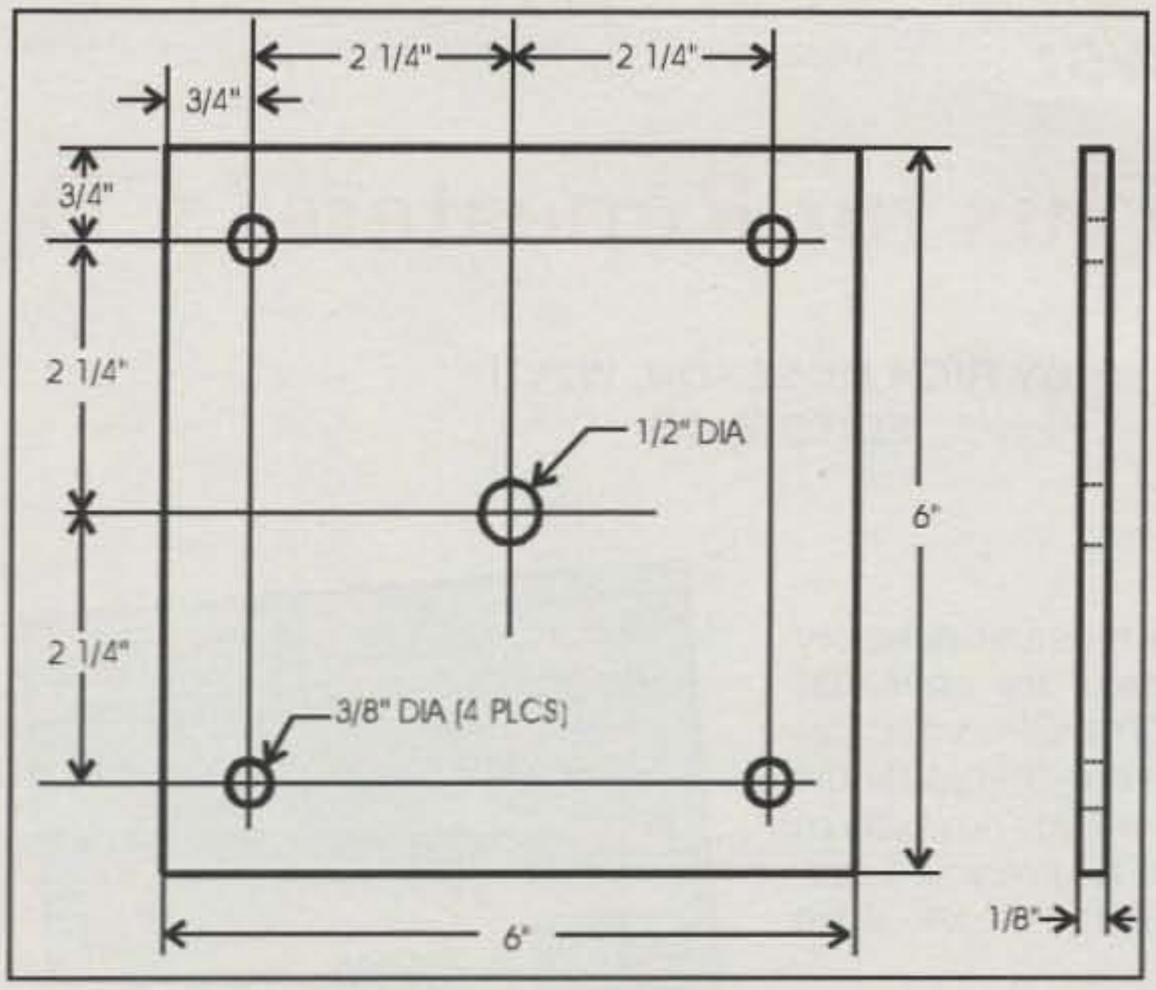
Fig. 5– SSFM assembly drawing and materials list (see text).

these frequencies the transmission line usually is several wavelengths long, and the radiation resulting from the common mode current on the transmission line, when combined with that of the antenna, produces an increase in the signal being launched at higher take-off angles. Unless you primarily are interested in talking to airplanes, a common mode choke should be employed for better performance of any antenna fed with a coaxial transmission line. The SSFM is no exception. The use of a common mode choke on the transmission line is just good engineering practice. It can't hurt and probably will only help.

You can make your own choke by coiling up a few turns of the coax, or better yet, by installing ferrite beads (W2DU type balun) at the antenna end of the transmission line. Complete details on making common mode chokes can be found in the *ARRL Antenna Book.*

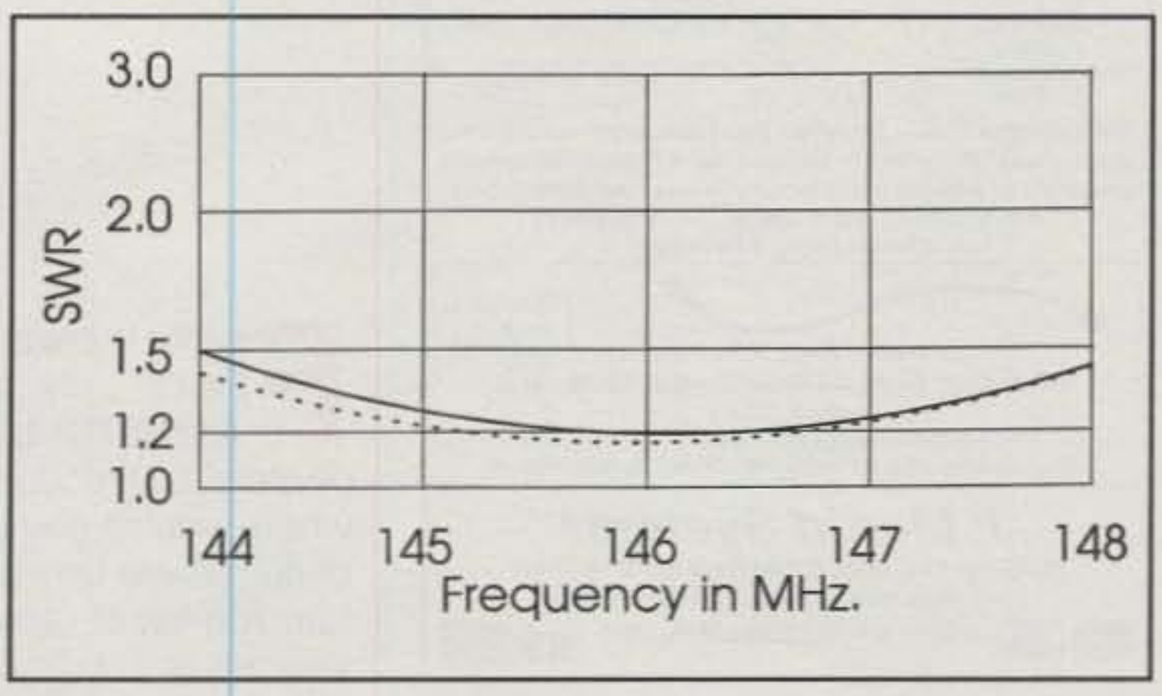
A Word of Caution

Not all VHF connectors are created equal! When I first constructed this antenna, I used a cheap CB mobile antenna adapter, obtained at a fleamarket, for the mounting of the center 3/4-wave-



← *Fig. 6– SSFM base mounting plate layout (see text).*

Fig. 7– Measured (solid line) and calculated (broken line) SWR values for the SSFM. ↓



length element. When measuring the SWR of the SSFM utilizing this adapter, I obtained readings of almost 1:1 at resonance and less than 1.2:1 across the entire 2 meter band. That seemed too good to be true—and it was!

On further investigation I found that the bargain antenna mounting assembly was no bargain at all. The unit had been constructed in such a manner that it had high losses at VHF, which in turn lowered the Q of the antenna, giving lower (and incorrect) SWR values. Although the SWR values appeared great, the antenna was not operating as efficiently as it should have been. It has been said, "Too low an SWR can kill you." It almost did in this case!

Conclusion

The Skeleton-Sleeve-Fed Monopole is relatively easy to construct, can be made with simple tools at low cost, and provides improved performance over a standard J-pole. Like the J-pole, the SSFM does not require any additional ground system, thereby making it an excellent candidate for operation on boats or on fiberglass motor homes. ■

KT4XA
2000 Young Ham of the Year

Christopher S. Arthur, KT4XA, of Russellville, Alabama, has been named the 2000 Newsline Young Ham of the Year. The award is co-sponsored by Amateur Radio Newsline, *CQ* magazine, and Yaesu USA. A senior at Russellville High School, Chris, 17, has been licensed since 1996.

Chris has been active in many aspects of ham radio, including traffic-handling and public-service communications. He is a co-founder of both the League of Young Radio Amateurs, a national club for young hams with over 100 members, and the International Youth Communications Council, a group designed to help young hams in other countries start their own amateur radio organizations. He is also webmaster of both groups' internet websites, as well as "ringmaster" of the Young Amateur Radio Operators Webring, a system that links more than two dozen websites and pages created by young hams.

The 1999 Young Ham of the Year, Michelle Swann, KE4EZI, presents the 2000 Young Ham of the Year plaque to her successor, Christopher Arthur, KT4XA, at the Huntsville (AL) Hamfest. (WA2OJK photo)

At the 2000 Huntsville Hamfest Chris was presented with his award, along with a Yaesu FT-847 transceiver (courtesy Yaesu USA), and a one-week trip to SpaceCamp (courtesy *CQ*), which he chose to donate to the Make-a-Wish Foundation. The presentation ceremony was covered by news crews from two Huntsville TV stations. Congratulations, Chris, from all of us at *CQ*.

On The Cover:

Astronaut Jerry Ross, N5SCW, works on connecting cables between the U.S. "Unity" module and the Russian "FGB" (Functional Cargo Block), or "Zarya" module of the International Space Station (ISS) during an assembly mission in late 1998. The small antenna sticking out from the right side of Zarya is the one that will be used for initial ham radio operations from the space station.

The first ISS crew—Mission Commander William Shepherd, KD5GSL; Flight Engineer Sergei Krikalev, U5MIR; and Soyuz Commander Yuri Gidzenko (callsign pending)—is scheduled to lift off for the orbiting space station at the end of this month. Components of a ham station should be waiting for them upon arrival. See KC4YER's exclusive interview with this all-ham space station crew, beginning on page 52 of this issue, to read about their plans for using amateur radio while in orbit. (Cover photo courtesy NASA)

CQ Reviews:

"TravelPlus for Repeaters" CD

BY RICH MOSESON, W2VU
EDITOR, *CQ*

Finally there's a repeater directory that's truly useful for travelers! The ARRL's "TravelPlus for Repeaters" CD requires only that you know where you're going and/or how you're getting there in order to give you a customized list of repeaters that are along your route.

One thing that has long bugged me about the traditional repeater directories is that there's no way to be sure which towns listed in the book are near your route, and which repeaters cover the area in which you'll be driving. "TravelPlus for Repeaters" solves that problem. When you start up the program, you're greeted with a map screen (default is centered on Dayton, Ohio; you can change it to center on or near your hometown). You then tell the program what bands you're interested in and what radius you want to cover (10 miles is standard), then start tracing your route, clicking on points where you'll be making a significant change in direction. Once you reach your destination, you tell the program to prepare a list of the repeaters you'll find along the way.

The database contains full *ARRL Repeater Directory* information, so you will be presented with a list of each repeater, including location, the area served, callsign, CTCSS tone, etc. You may then customize that list if you want to, and print it as your personal repeater guide for your upcoming trip. If you are flying someplace, just click on your destination, give it band and radius information, and create a list. You'll know where to look for activity from your hotel room.

Be careful not to make your search too broad. I set up "TravelPlus" to show me repeaters on 2 meters and 70 centimeters for a trip from my home QTH in New Jersey to Bar Harbor, Maine, using a 20-mile radius from the highways. It came up with over 500 repeaters! Even after scaling back for the local-area repeaters I know I won't be using, I still had over 400! I don't expect to have trouble finding people to talk to on this trip.

That's not all the "TravelPlus for Repeaters" CD has to offer. The recently released version 4.0 will show you grid-square boundaries on the map if you'd like, and whenever you move the cursor on your screen, it constantly updates the latitude, longitude, and grid square. You also can coordinate TravelPlus listings with commercial travel planning software (such as the Delorme Street Atlas); with added software, you can export listings to a handheld Personal Digital Assistant (such as a Palm organizer); and if you have a GPS receiver tied into your laptop or PDA, you can have the software read in your current GPS reading and tell you what repeaters are within your selected radius of wherever you happen to be. Finally, if you want to know where to find a local traffic or SKYWARN net while you're away, the entire *ARRL Net Directory* is on the CD as well.

Minimum system requirements are an IBM-compatible PC with a Pentium class processor and CD drive, Windows 95, 98 or NT, high-color 16-bit (640 × 480) graphics, 16 megs of RAM (with 32 or more recommended), and at least 4 MB of available hard-drive space.

"TravelPlus for Repeaters" version 4.0a is available for $39.95 from many ham dealers and from the ARRL, 225 Main St., Newington, CT 06111; 860-594-0200; web: <http://www.arrl.org>.

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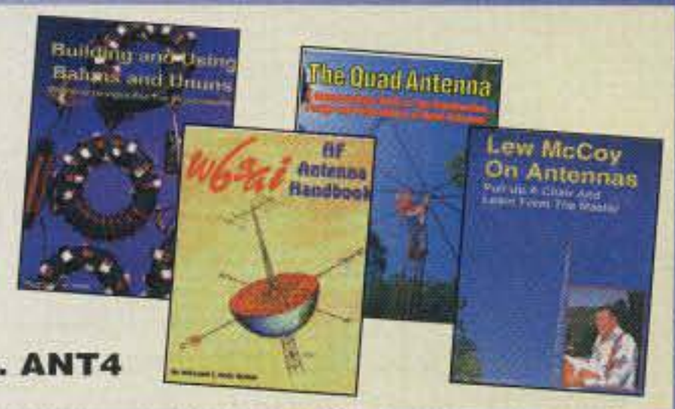

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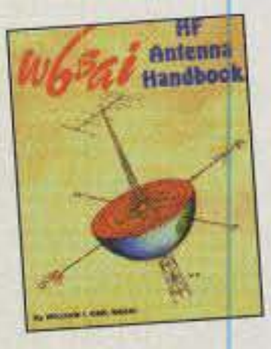

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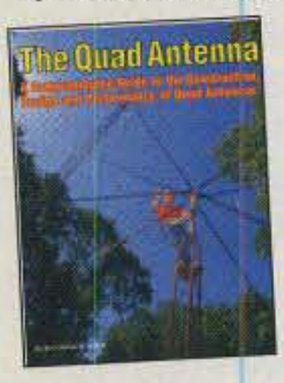

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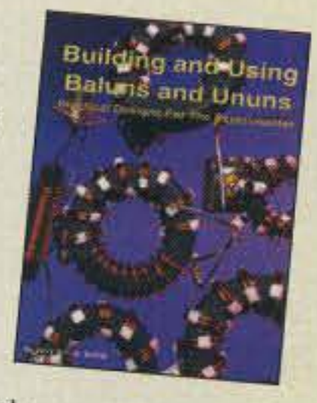

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Amateur Satellites

BY PHILIP CHIEN, KC4YER

Ham Radio in Space

CQ Interviews: The First International Space Station Crew

In his 1984 State of the Union address President Reagan called for NASA to build a large, sophisticated space station in eight years for $8 billion. Now 16 years later, with a total cost of over $60 billion, it's finally happening. Space travelers Bill Shepherd, KD5GSL, and Sergei Krikalev, U5MIR, have been in training for almost five years; Yuri Gidzenko (callsign pending) has been in training for about four. For many years the crews kidded that they have always been one year away from launch. Now, however, the light at the end of the tunnel is visible. The crew is scheduled to launch on a Soyuz rocket from Kazakhstan at the end of October.

As we go to press in mid-August, the space station's initial ham radio rig was supposed to be delivered by the space shuttle Atlantis in September, so it should be sitting there waiting for the crew. When the crew arrives at the space station, it's going to be similar to arriving in a new house: The movers have left boxes all over the place and some of the things haven't been installed. Obvious key tasks that must be completed include putting in the toilet's final plumbing, putting in the secondary life-support systems, and activating all of the computers. The crew is going to be extremely busy setting up everything. Officially, ham radio isn't an extremely high priority, but don't be surprised if the crew members decide to set it up on their own when they have some spare time available.

The difference between week-long shuttle missions and four-month stays aboard space stations is similar to the difference between short business trips and long-term stays in another city. You have to take different approaches. Astronauts on space stations need holidays, weekends, and more relaxed schedules. They can't function continuously at the breakneck pace of a shuttle mission. Fortunately, this means there is more time for hobbies such as amateur radio. However, it's important to remember that just because an astronaut has passed an amateur radio test and obtained a callsign does not mean he's an experienced or enthusiastic ham radio operator. Some space travelers will want to use the space station's rig to talk to their families and personal friends, while others will want to talk to hams around the world.

In theory, English is the official language for the space station. But in practice, all of the crew members need some abilities in both English and Russian. Shepherd says, "I think technically I can understand what I need to do to operate the space station. I'm not as good with my conversational Russian or off-the-cuff in the political/diplomatic arena being able to talk to Russian when I want to." Krikalev is fluent in English, but he does have a strong accent. Gidzenko's English is passable, although he occasionally needs help with a particular expression or phrase. In any case, if you're used to international ham radio communications, you shouldn't have any language problems when talking to the station crew members.

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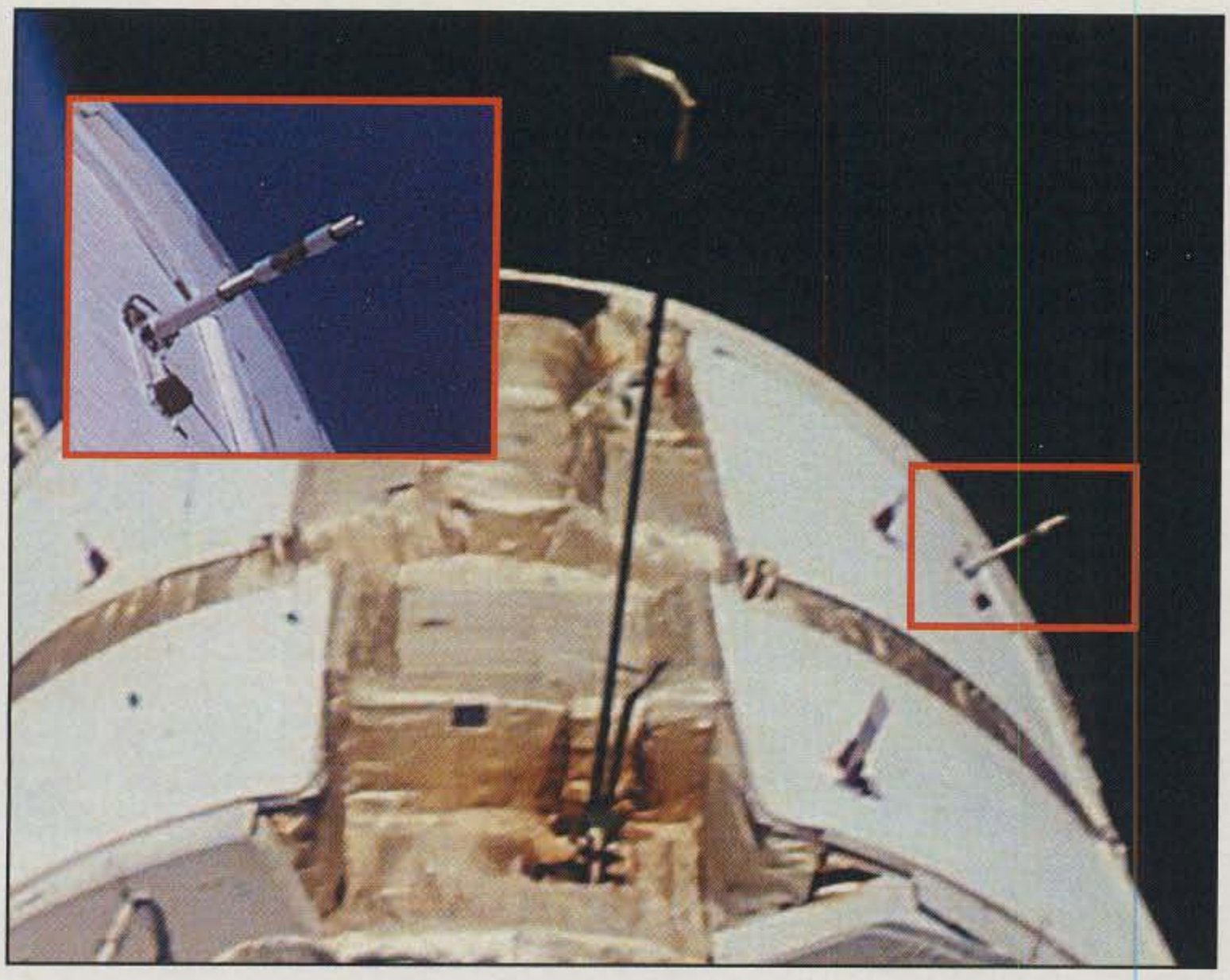
Launch of the Zvezda service module for the International Space Station (ISS) last July aboard a Russian Proton rocket. The service module will house the initial ham station aboard ISS. (All photos courtesy NASA)

CQ was the only amateur radio magazine to extensively interview the three "Expedition One" crew members and ask them how they think they're going to use ham radio on the space station.

William Shepherd, KD5GSL

Expedition One commander William "Shep" Shepherd, KD5GSL, has been an astronaut since 1984. Before that he was a Navy SEAL. Shepherd's first space flight was the STS-27 flight, a top-secret military mission. His second space flight, STS-41, sent the Ulysses spacecraft on the start of its journey over the Sun's polar regions. That flight also featured the first flight of a Macintosh Portable computer as part of a series of tests on how well trackballs and other pointing devices work in space.

Shepherd's most recent space flight was STS-52 in October 1992. That flight deployed an Italian LASER reflector satellite and performed many microgravity experiments.



This is the antenna that will be used for initial ham radio operations aboard the International Space Station.

After STS-52 NASA managers asked Shepherd to take a desk job managing the space station program and the addition of Russia to the multi-national project. Shepherd had hoped to be assigned to one of the assembly missions as a space walker, but instead he was selected as the first space station commander in late 1995. At that point the flight was planned for early 1998.

Shepherd's hobbies include sailing, swimming, and working with tools in his garage. While he earned his amateur license for his space station flight, he is not an active ham on the ground. Shepherd's wife, Beth Stringham, is obtaining her ham license so she can talk to him while he's in space.

Shepherd said, "I haven't done much with it [the ham license], but for the purposes of the flight I went out and got my license. I'll get on it as time permits. I'm looking forward to talking to family with it. Nothing specific yet [talking to hams], but I'm sure just based on talking to Yuri and Sergei we'll get a lot of contact with people on the ground, so I think I'll just have to see how that goes.

"[Sergei and I] had a great discussion [about ham radio]. [Sergei] was flying somewhere over South America and talking to some guy in a vehicle apparently parked on a fairly high piece of ground. This mobile station thought he had pretty good communications, talking to Sergei. He responded that Sergei's communication was coming in pretty strong, so Sergei had to be pretty high. He asked him. Sergei said, 'I'm pretty high up' and this guy just couldn't understand that Sergei was orbiting overhead and that's why his signal pass was pretty clean."

Shepherd indicated that he'd like to do something similar—talk to someone who doesn't realize that he's having a QSO with somebody who is in space.

Of the three crew members Shepherd is the only one who can vote in the November U.S. elections. He plans to do so by absentee ballot and said he's extremely interested in finding out the election results.

Yuri Gidzenko

Soyuz commander Yuri Gidzenko (callsign pending) became a cosmonaut in 1989. He was the commander of the Mir 20 mission, which spent five months on the Mir space station from September 1995 to February 1996. During their mission the STS-74 shuttle flight visited Mir, adding the docking module for later space shuttle docking flights. During the joint period all five shuttle astronauts and all three Mir cosmonauts were licensed to use the ham equipment. It also marked the first time space travelers representing four countries—the United States, Russia, Canada, and Germany—were in space together.

The STS-74 mission also carried back cargo from Mir, including medical samples. The samples needed to be frozen for their return to Earth, but there

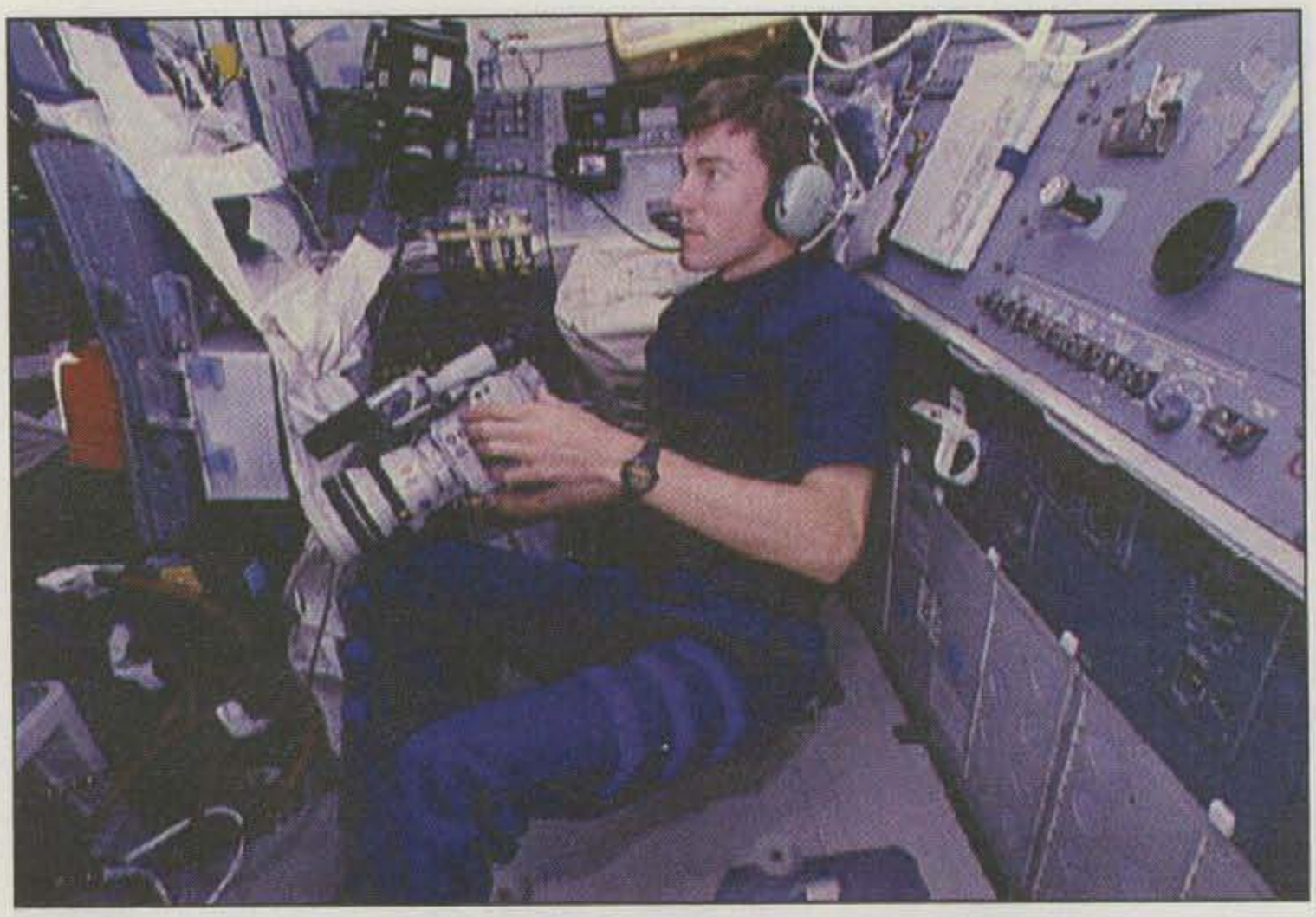
ISS Expedition 1 crew in front of a shuttle simulator. From left, Flight Engineer Sergei Krikalev, U5MIR; Mission Commander Bill Shepherd, KD5GSL; and Soyuz Commander Yuri Gidzenko (callsign pending).

was nothing which needed to be frozen on the way up to Mir. Shuttle commander Ken Cameron convinced his managers to fill the freezer with high-quality ice cream. The shuttle crew took out an occasional piece (for quality-control purposes), but turned over the rest of the ice cream to the Mir 20 crew as a present. Gidzenko enthusiastically said, "It was nice—very nice," and mentioned that it took the three-person crew about a week to eat all of the ice cream.

Gidzenko's hobbies include a variety of sports including swimming, soccer (international football), and tennis.

Gidzenko had a very amusing experience with amateur radio on Mir. A ham on the ground told Gidzenko various sports scores, much to the frustrations of the ham's wife. She didn't believe him when he said that he had to watch a particular game on television because he was keeping a Russian cosmonaut informed about what was happening on Earth. Gidzenko thus had to send a letter to the ham's wife explaining that yes, her husband was telling the truth when he said he was watching the game for a Russian cosmonaut in space!

Gidzenko has indicated that he'd like to hear about anything from hams on the ground, but especially basketball, soccer, and NHL hockey. He did not say, though, whether or not he'd be willing to write explanatory notes to your YL if necessary.



Space station Flight Engineer Sergei Krikalev, U5MIR, talks with students in Maine via ham radio from the shuttle Discovery in 1994 while preparing a camcorder for later use.

Sergei Krikalev, U5MIR

Flight engineer Sergei Krikalev, U5MIR, is one of the world's most experienced space travelers. He became a cosmonaut in 1985 after many years as a Russian space program engineer.

Krikalev's first space flight was the fourth long-duration expedition to Mir—151 days in space from November 26, 1988 to April 27, 1989. During this mission the Mir space station only had two components, the Mir baseblock and the Kvant-1 module. The ham radio equipment had been installed and activated by the previous crew.

Krikalev's second space flight resulted in one of the most bizarre myths about Mir. He was launched on May 18, 1991 for a planned four-month stay in space as a member of the ninth Mir expedition. By this point Mir had two additional modules, Kvant-2 and Krystall. The next Soyuz spacecraft was supposed to carry a crew of three—two replacement cosmonauts and a guest "cosmonaut researcher" from Austria. Austria would pay $7 million for the week-long mission.

Similar guest space fliers have occupied the third seat on the Soyuz for many missions, including Frenchman Jean-Loup Chretien and British Helen Sharman on Krikalev's previous flights. However, changes in the economic situation forced the Russian space program to cancel one Soyuz crew-swap flight, so the paying Austrian had to fly, along with the next cosmonaut researcher, a VIP from the Republic of Kazakhstan.

All Soviet space travelers have launched from Kazakhstan. Most cosmonauts are Russians, but others come from the Ukraine, Belarus, and other republics which formed the Soviet Union. There had never been any Kazakh space traveler, though, so it was important to fly a native Kazakh to Mir as a political gesture. The only way to combine the two Soyuz missions was to fly a Russian commander with the two VIP passengers from Austria and Kazakhstan. On orbit the commanders could be swapped out as planned, but neither of the VIP passengers was qualified for a long-duration space mission. Thus, the flight engineer on Mir, Krikalev, would have to remain onboard, in effect a double-shift in space.

The swap-out went as planned, and Krikalev and his new commander, Alexandr Volkov, continued as the tenth Mir expedition. They continued their research activities, repairs to Mir, and a space walk to work on a large girder. During Krikalev's extended stay there was always another cosmonaut onboard, he always had enough supplies, and if there was a major emergency he and his commander could have re-

turned home in their Soyuz spacecraft at any point. Somehow, however, the myth started that Sergei was stranded on Mir with no way to get home. In some variations of the myth he was by himself. The myth wasn't believed by many hams in contact with U5MIR, though, as he told all of them that he'd be coming home in March when Expedition 10 was relieved by its replacements.

During Krikalev's eleven months in space, the Soviet Union went through a radical change, with a failed coup to take over the government and the evolution of the USSR into the Commonwealth of Independent States. Krikalev said, "There wasn't anything we could do about it, so we just concentrated on our work."

On March 25, 1992 Krikalev and Volkov returned to Earth to a country different than the one from which they had been launched.

In 1993 Sergei Krikalev and Vladimir Titov were selected as the two Russian cosmonauts who would fly on the space shuttle. In exchange, one U.S. astronaut would fly a long-duration mission on Mir.

Sergei was assigned to the STS-60 mission as a Mission Specialist, responsible for many of the experiments, activities involving the shuttle's Wake Shield Facility, and operating the shuttle's robot arm. The Shuttle Amateur Radio Experiment (SAREX) was added to the flight mostly because of his interest in ham radio.

A technicality almost prevented Sergei from using SAREX on the shuttle. The U.S. and Russia don't have a third-party agreement, which would have severely limited school and family contacts during the STS-60 mission. The SAREX team tried to get a third-party waiver for many years. It finally came, but only after the shuttle launched, in the form of a one-week waiver just for the STS-60 mission.

Sergei's most recent space flight was on the STS-88, the first assembly flight for the International Space Station. The decision was made to add a Russian cosmonaut to the existing shuttle crew, primarily for additional insight into the Russian systems on the space station. Sergei knew the shuttle and space station, making him the most appropriate candidate. Sergei was asked what he thought of the station, and he replied "Needs more modules."

Besides ham radio Krikalev's hobbies include swimming, skiing, bicycle riding, and acrobatic flying. At one point Krikalev was a member of the national acrobatic flying team; he was the national champion for two years. He's indicated that he'd like to talk to hams about what's going on in general, and "I flew in acrobatic team, I would be interested in what's going on in that area." Sergei said, "The nice thing about ham radio operators: they don't need to report something. This is random communications. We don't know when we'll have time to use the radio; it will be spontaneous. If people tell us what's going on it will be nice."

It's been eight years since Krikalev has had the opportunity to use ham radio on a long-duration mission. In the meantime he has been able to meet many of the hams who talked with him while he was on Mir, and he's indicated that he'd like to renew his relationships with them as well as meet new hams while he's on ISS.

Sergei has met some of the hams he talked with on his long-duration Mir missions and the STS-60 flight, but they're the exception. Sergei said, "Some of them I've never heard from since my Mir flight. I hope to hear my old friends on this flight."

The Expedition One crew is expected to spend four months on the International Space Station. The Expedition Two crew members are commander Yuri Usachev, R3MIR, and American astronauts Susan Helms, KC7NHZ, and Jim Voss, (callsign pending). They will launch to the space station on the STS-102 mission, currently scheduled for February 2001. The shuttle that brings them to the space station will return the Expedition One crew to Earth.

Coming Up:
Working the Space Station

Next month in *CQ:* the space station's ham radio hardware, the proper procedures for contacting the space station, the best times to call the crew members, the rules, and everything else you need to know to talk to an astronaut or cosmonaut in space.

73, Phil, KC4YER

Digital Wireless

Packet Radio and Beyond

BY STEVE STROH, N8GNJ

Amateur Radio Networks and the Internet

Many in amateur radio see the internet as a fabulous "support" mechanism for the hobby, useful for sending around bulletins, thousands of individual ham-radio-related web pages, discussion groups, software distribution, etc. I feel that to restrict the internet to that role is to lose a tremendous capability. It's my strong feeling that amateur radio should wholeheartedly *embrace* the internet and its capabilities, and do so *directly* rather than indirectly.

Content

The first reason why I feel this way is *content*. Simply put, left to its own internal content, amateur radio digital content isn't that exciting overall. That said, there are pockets of interesting content out there, but not much. I'd guess that a lot of packet radio networks and servers (BBSes) were taken out of service for just that reason; the content wasn't compelling enough to justify the time and effort required to access it (for example, maintaining a packet BBS for "For Sale" notices, etc.). Late last year I logged on to a BBS for the first time in several years, and was appalled at the crude user interface, but even more appalled at the uninteresting content. If that were the only thing I could access through my TNC, I'd probably not bother, and it's my guess that's why a lot of folks want to do so.

Of course, there is the "build it and they will come"/"build it for the love of building it" faction that keeps servers (and repeaters) up because they like it, but they have very few users. For the rest, though, it's a lot more fun to build or use something that takes some effort if there's some interesting *use* for it.

In contrast, the amateur radio content on the internet is far more interesting. There are numerous mailing lists and news groups, web pages, etc. Some would argue that's the internet, not amateur radio. I'd agree, except that the content to which I'm referring is *about* amateur radio, and it happens to be *located* on the internet. Why not combine the two? Many groups do exactly this with their packet networks and servers—distribute amateur-radio-related content via amateur radio. Yes, it's a bit more of a challenge to get it (log onto a BBS, learn how to configure a personal station to accept e-mail directly, etc.), but there's sufficient reward (the interesting content) to make it worth the effort.

Some argue that this makes amateur radio just another part of the internet. To some extent that's true and illustrates nicely one of the key strengths of TCP/IP: It works over any transport mechanism—RS-232 cable, Ethernet, fiber, wireless, laser, satellite, etc. Some hams feel strongly that amateur radio is "just another network" that is part of the internet. Others don't think there should be any content or other interconnection with the internet. I'm more middle-of-the-road; I think that internet content and "services" that pertain to amateur radio should be encouraged to be accessible from amateur radio. I think that's a fair and reasonable balance between the two viewpoints. Realistically, however, this is an all-or-nothing proposition; access to internet content can't be selective (although many, many will try). If the capability exists, some will use it for non-selectively and access non-amateur-radio content from their internet connection. On the whole, I think that amateur radio is far more strengthened than damaged by interconnection of the internet and amateur radio networks.

Relevance

For me, the most powerful argument for having interoperability between the internet and amateur radio networks is relevance. The internet is successful beyond all comprehension, including the wildest imaginations of its designers. It is changing life daily, and for many is more relevant in daily life than the telephone or the television. Ask the students who have 10 Mbps internet access from their dorm if they'd rather have a phone, television, or a laptop. My guess is that you'll hear laptop far, *far* more frequently than television or phone. To have interconnection with the internet makes amateur radio relevant to many, especially the younger crowd. Put another way, which of the following phrases do you think will more interest a teenager: "Want to learn more about amateur packet radio?" or "Want to learn about wireless internet access you can experiment with?"

Think hard about this...If amateur radio isn't relevant to the younger generations, then it will inevitably die out. Internet use is increasingly becoming the dominant communications technology of young people's lives (behind only cell phones, pagers, and "hanging together"). We would be foolish not to embrace that trend and figure out how to make effective use of it.

Solves Nagging Problems

Internet interconnection with amateur radio networks solves a lot of nagging problems. One example is that wide-area networks using amateur radio exclusively is very tough to do. It's one thing to put up a few nodes and quite another to maintain them and repair them when they fail. In a lot of areas there simply aren't enough hams, enough sites, or enough money to put up a network. It seems to me that instead of "punting" and going completely commercial in that situation, a reasonable compromise would be do as much of the network as is practical with amateur radio, and then treat the internet as a "tunnel" between other amateur radio networks. Some feel "well... just use HF as the link." Bad idea. HF isn't fast enough to keep up, and HF spectrum is too precious (and too interesting to use in other ways) to dedicate to such use.

Another nagging problem is incompatible networking standards in use in amateur radio. Simply put, the services and capabilities possible with the use of TCP/IP (and interconnection with the internet) far exceed the capabilities of "amateur radio" networking systems. TCP/IP can adapt easily to low bandwidth communications while remaining seamlessly interoperable with higher speed communications and internet interconnection.

As an aside, TCP/IP is often poorly implemented in amateur radio, which has resulted in something of a bad reputation. Admittedly it's tougher to get

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TCP/IP running, and TCP/IP does have more overhead. For TCP/IP to work well, it really needs a high-quality channel. Speed of that channel is not nearly as important as the quality of the channel. In the Seattle area we have been using amateur radio TCP/IP exclusively for years. It does work very well, but we've had to invest a lot of time in learning how to do it right.

Technical Training

Most wireless (data) communications systems are now interoperable with the internet because customers are demanding it. Even receive-only pagers, about the simplest wireless data devices, are now internet-enabled and can receive e-mail and other internet-based content. Wireless phones are gaining "chat-mode" capabilities—for example, wireless messaging compatible with America Online's Instant Messenger service. Wireless-to-internet interconnection is one of the hottest trends in commercial wireless now, and it only makes sense to me that there's more justification in devoting time to amateur radio if doing so has the potential to enhance one's career skills. For those who are already employed in the wireless or internet areas, it seems to me that amateur radio is a perfect way to experiment with such concepts. Short messaging is in its infancy, and far from perfect (for example, it's not "reliable"; there's not much done when the message is transmitted to ensure that it's transmitted correctly or it reaches the destination); thus there's lots of room for innovation and improvement.

Emergency Services Support

I've observed that there has been much more interest of late in amateur radio TCP/IP, as it's become more widely understood that it's possible to transport "real e-mail" in an emergency. In this case, "real" means conventional SMTP/POP "internet" e-mail such as Eudora, Netscape Mail Client, Outlook Express, etc. (in contrast to amateur radio BBSes, e-mail, etc.), that most people use. In a lot of cases, if support organizations working through a disaster could use their e-mail systems, they would be much more effective. Ideally, support consists of a laptop computer and the usual packet radio equipment. The laptop has an Ethernet card in it and software installed that acts as a router between the Ethernet connection (connected to the LAN) and the packet radio network and its associated internet gateway. With some very minor changes to the support organization's computers for the duration of the emergency (basically changing the default gateway setting to route through the router laptop), the organization can then send e-mail again via an amateur radio network—slower than what they're used to certainly, but very usable.

Some Examples

• The Microsoft Amateur Radio Club (www.microhams.com) came up with an incredibly good idea of streaming the audio of their new repeater via the internet. They can monitor the repeater from their computer with nothing more than the normal web browser and an internet connection. Of course it helped a lot that MicroHAMS was able to obtain "very reasonable terms" for the "streaming server" software, and they have plenty of bandwidth available with which to stream the audio. This is real "out of the box thinking," and it seems to me that this capability will be extremely popular. It's a very inexpensive way to find out what repeaters are all about (and how much *fun* they are) before investing in even minimal equipment.

• A number of repeaters have been linked using Voice Over IP (VOIP) technology, normally used for chatting between individuals and "free telephone," to form extended repeater networks. This gets really interesting when repeaters are linked on different continents. I easily can see this becoming huge, and linkages changing from month to month. What a fabulous way to get to know other hams in different areas, sharing ideas and swapping experiences over the relative intimacy of a repeater, contrasted with the much more sporadic nature of individual contacts over HF. (It is interesting to note that MicroHAMS' implementation of streaming audio points out a potentially different approach—connect up repeaters with streaming audio rather than VOIP.)

• Those who prefer to "lock down" their internet connection to allow connections only with other amateur radio operators will find Net 44/AMPRNet (www.ampr.org) very useful. Mirrorshades, a router at the University of California at San Diego, allows otherwise unconnected Net 44 amateur radio networks (those that make use of the 44.x.x.x IP address space) to "tunnel" or "encapsulate" Net 44 packets via the internet. Mirrorshades "un-encapsulates" the packets and "re-encapsulates" them for delivery to other Net 44

networks. There is an extensive network of Net 44 gateways in operation.

• I mentioned in last month's column the Igate short message system developed for APRS. The more I learn about this system, the more impressed I am by its elegance and simplicity. Briefly, an Igate (APRS to internet gateway) connects to the master Igate server on the internet via a commercial internet connection of almost any kind (dial-up is adequate) and then listens to an APRS channel and basically repeats all packets heard on the APRS channel back to the master Igate server. The master Igate server then "echoes" those packets out to every other Igate server (via the internet connection). The Igate server compares short messages received from the internet with stations heard on the APRS channel. If there is a match (and *only* if there is a match) the short message is gatewayed onto the APRS channel. This system works because the bandwidth of the internet connection is so much higher than the amount of traffic being sent, and there is easily enough computing power to do the comparisons and the message transmission. What impresses me is that a similar capability for Short Messaging is just now emerging in the commercial wireless phones, and that's a long way from being universal. The Igate system has its problems. It's very much a work in progress, but it illustrates perfectly why amateur radio should not attempt to "isolate" itself from the internet.

• It's long been a tradition in amateur radio to handle *personal* third-party messages. In the late 1990s and beyond that has come to mean e-mail a lot more than radiograms. There are a lot of people now, and for the foreseeable future, beyond the reach (operationally and especially financially) of commercial "thin route" e-mail access. Amateur radio is capable of bridging that gap well, and if the messages originate or terminate with a licensed amateur radio operator (assuming third-party rules are in place in the operator's country) and the message is of a personal nature, it seems to me that gateways should exist, assuming the proper safeguards, to pass such messages largely automatically between amateur radio and the internet.

New Breed Amateur Radio Clubs (and Amateurs!)

I was really happy to see MicroHAMS come into existence. That was all the validation I needed that there *is* a place for amateur radio in the lives of those in technology fields who might feel that amateur radio is "hopelessly outdated." MicroHAMS illustrates some important trends in our hobby.

• The first is that such hams and organizations see amateur radio through their own unique perspective. For example, a highlighted club project is to build a simple 20 meter transceiver to be used exclusively for PSK31.

• I discussed the audio output of the repeater being transmitted via streaming audio technology, making it possible to anyone with internet access to listen to the repeater. I expect that it won't be long before a "reply" capability via a web browser is possible.

• Most of MicroHAMS' internal communication is done via the web page and e-mail mailing lists. Their meetings are very focused; it is likely that no "business" is conducted there (that's been handled via e-mail) and no paper newsletter is needed (It is assumed all members have web and e-mail access.).

• The activities of the club are at least somewhat relevant to the members' professional lives. Microsoft is a company that is intensely technical, and although wireless is currently not a large part of Microsoft's overall business, it is a very relevant area of interest to Microsoft.

• Most of all, and most profound, from all appearances, the members of MicroHAMS are having *fun*. That's a concept largely lost to a lot of amateur radio groups, where business meetings and other administrivia dominate the meetings, where the same old arguments dominate the discussions, and where not much *fun* is happening. That gets old after a while, and people generally decide that something that is truly optional in their lives and isn't much fun isn't worth doing, so they stop. We have lost a *lot* of hams that way.

In summary, the internet isn't the enemy. It's a fabulous tool that amateur radio can make use of to markedly enhance the hobby. Let's get busy!

Please let me know your story about cutting-edge amateur radio, including how your group has implemented internet interoperability.

73, Steve, N8GNJ

World Of Ideas

BY DAVE INGRAM, K4TWJ

A Look At The World Around Us

Resurrecting Simple, Fun Rigs from the 1950s—Part II

Say last month's column kindled your enthusiasm for getting on the air with a '50s-style rig? Maybe you would like to do it with some simple, yet unique gear, or possibly you found and restored a neat little '50s receiver, but are still hunting for the perfect one-tube transmitter to mate with it. Well, friends, this month's column is devoted to you. In the spotlight this time is an irresistible 6AG7 transmitter built "low boy" style on a breadboard, plus something quite special—a mini CW trans-receiver, or "rushbox," you can build from readily available parts right now. We even have a couple of catchy spin-off expansion ideas to go with the mini rig and whet your creative thinking. It is '50s fun at its golden best, so get ready for some genuine radio thrills supreme and let's once again return to those exciting days of yesteryear!

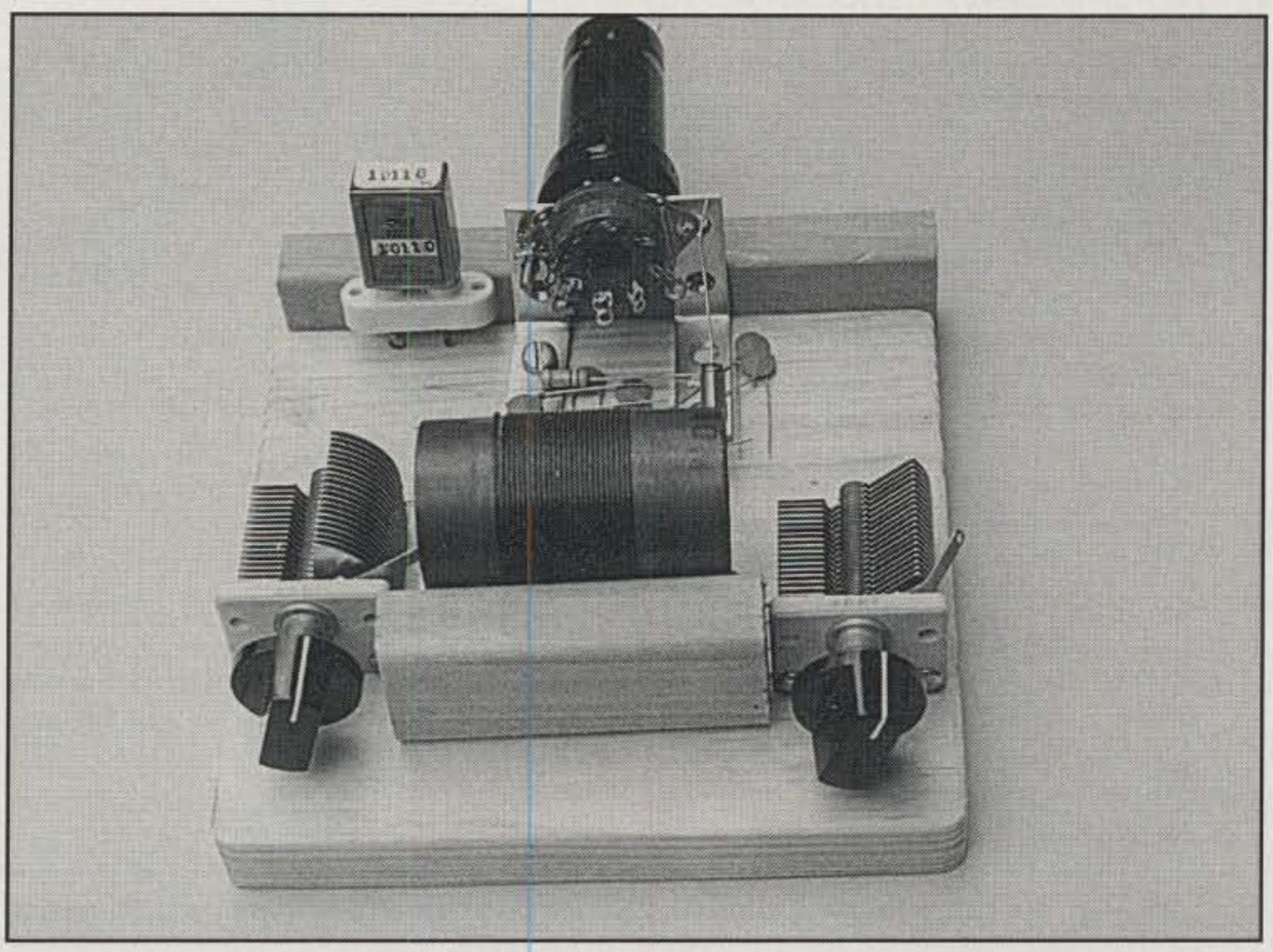

Photo A– Stovepipe Annie during her very first stage of assembly. The coil and crystal will be mounted to the board with small screws and plastic spacers. Other components will be direct-wired to tube socket pins "ugly construction style" as discussed in the text.

Stovepipe Annie

If you started in amateur radio during the early 1950s, you probably remember (or used!) an easy-to-brew 6L6 or 6V6 transmitter described in the ARRL's 35 cent booklet "How To Become A Radio Amateur." It was built on a wood crate-type frame, used penny-sucker sticks as a coil support, and is still one of today's most often duplicated rinky-dink Novice transmitters.

An equally captivating, but less well-known easy-to-brew treat from that same era is the sweet little 6AG7 transmitter illustrated in photo A, fig. 1, and fig. 2. The rig's circuit diagram is fairly common, but its real beauty is in the way folks assembled it. Some built the transmitter conventional tube-upright style on a breadboard, some built it on an inverted cigar box, and some built it on a QSL-size metal chassis. The most heartwarming layout of all, however, has to be the open-air, tube-horizontal arrangement shown during its first steps of construction in photo A. Now, friends, this is a genuine Novice transmitter of the best kind! Indeed, it does not know its own limits and runs all over FT-1000s, IC-756s, and TS-970s. That's right: You must disconnect its high voltage and hide its antenna cable to stop the thing from working DX! It hunts 'em down and nabs 'em solid on the first call. What a rig! Ready to build one and set the bands ablaze? Let's start with some introductory facts and mechanical details, then bring in a few technical notes.

Basically, this transmitter is a 7 to 10 watt input, 4 or 5 watt output crystal oscillator with a pi-net output or "tank" section to match both low-impedance dipoles and high-impedance longwires. It originally was designed to work 80 and/or 40 meters, but a quick crystal change and coil tapping (or swapping) also "updates" it for operation on today's QRP-favoring WARC band of 30 meters. The 6AG7 tube is special because it has a jet-black "stovepipe" metal envelope rather than a glass envelope. Polish the tube with a couple of coats of car wax, operate it a few minutes on the air so it gets hot-hot to the touch, and it absolutely sparkles (steams?) with old-time glamour!

With the exception of horizontal tube mounting and use of two small wood blocks to protect fingers from high voltage, layout is similar to 1940-style breadboarding. Who knows? This may have been the first generation of "ugly construction." The tube socket is supported with a pair of 1 1/2 inch angle brackets secured to the 1 by 6 by 8 inch wood base with screws. The crystal socket is mounted with small angle brackets or standoff insulators (use whichever you have on hand). A rear-mounted five-screw-type terminal strip on the tube's opposite side is used for connecting voltages and a key, while a similar two-screw terminal strip mounted behind the pi-net's output/loading capacitor is used as an antenna connector. Small components (resistors, bypass capacitors, and RF chokes) can be laid out or positioned on the wood base according to personal taste.

4941 Scenic View Drive, Birmingham, AL 35210
e-mail: <k4twj@cq-amateur-radio.com>

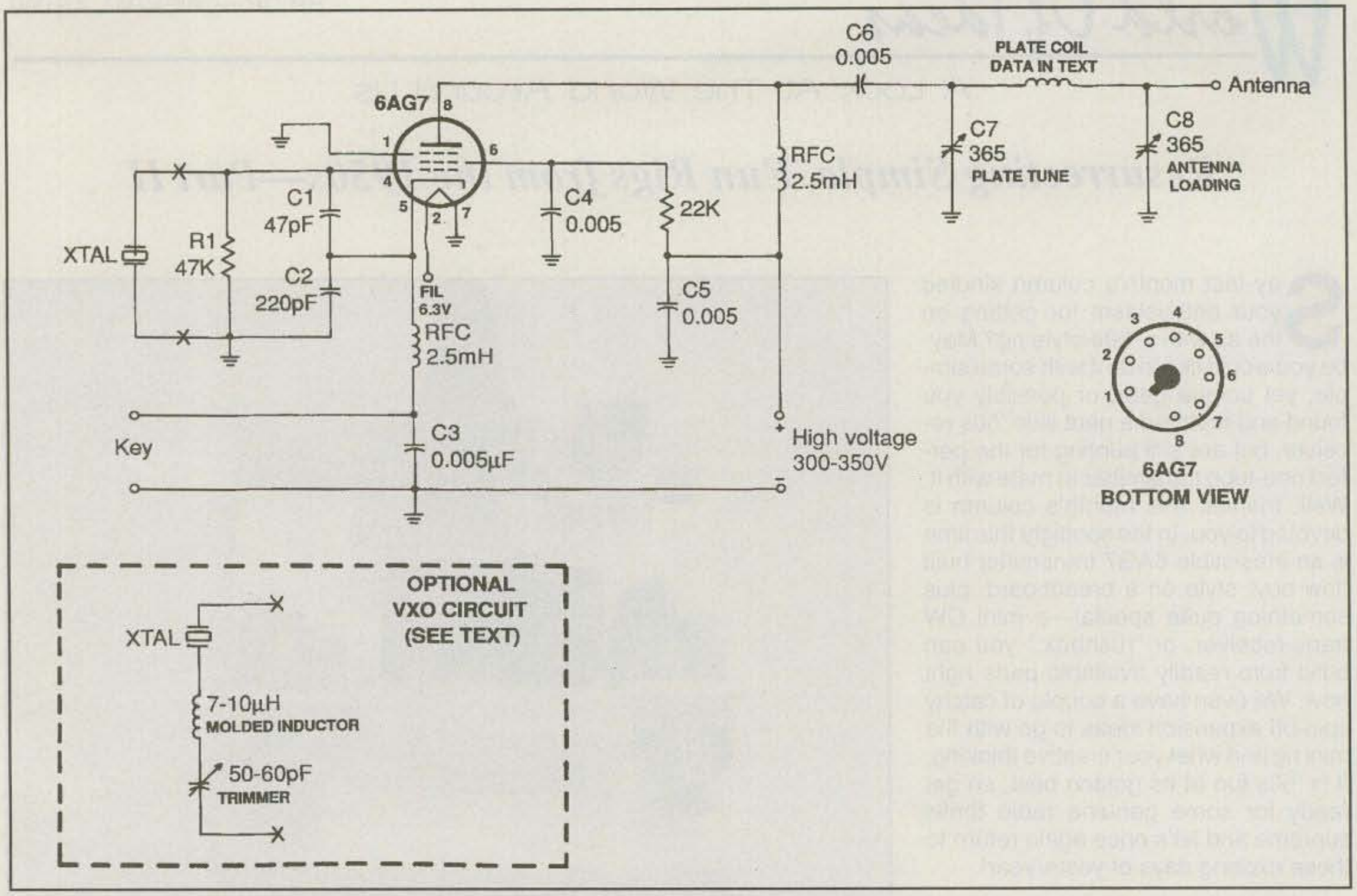

Fig. 1– Circuit diagram of the "Stovepipe Annie" transmitter with inset of the crystal-warping/VXO circuit.

Wiring can become a busy maze on the small base board, so slipping short lengths of insulating "spaghetti" over various wires that do not connect to ground proves quite helpful. With respect to circuit components, any value between 15K and 47K ohms is fine for R1, and any value between .001 mFd and .005 mFd is fine for C3, C4, C5, and C6. If you experience a chirpy signal, substitute a 4 to 47 pFd trimmer capacitor for C1 and tune it for the cleanest sound. The only additional suggestion I offer is routing a ground buss from one side of the crystal socket to one side of the pi-net's output capacitor and then connecting all circuit grounds to that common buss line.

The pi-net, or "tank" coil, originally used in this transmitter was cut from a section of B&W 3016 coil stock. You probably cannot find B&W coil stock today, but do not throw in the towel. A comparable coil can be homebrewed by winding number 24 wire on a 1 inch diameter form, plus you can even tailor the number of turns for each band to mate with on-hand tuning capacitors. If you have 150 pFd variable capacitors, wind a 70-turn coil for 80 meters, a 35-turn coil for 40 meters, or a 20-turn coil for 30 meters. The coil should be 2 1/4 inches long for 80 meters, 1 1/8 inch long for 40 meters, and around an inch long for 30 meters. If you use common 365 pFd variable capacitors, wind 41 turns for 80 meters, 20 turns for 40 meters, and/or 14 turns for 30 meters. If you prefer, you can also substitute the full pi-net circuit shown last month in Ameco's AC-1 transmitter in this 6AG7 rig. In that case, the coil is wound on a 1 1/2 inch diameter form using number 22 or 24 wire. Wind 28 1/2 turns for 80 meters, 15 1/2 turns for 40 meters, or 10 turns for 30 meters. On 30, use a 400 pFd tuning capacitor and a 900 pFd loading capacitor. How's that for versatility!

A simple 300 to 350 volt DC power supply like used in the Ameco AC-1 transmitter also works fine for this 6AG7 transmitter. Just remember to utilize a hefty transformer (150 ma or larger) and an "overkill" filter capacitor (such as 40 or 60 mFd). Why? It ensures plate voltage holds steady between key up and key down to minimize chirps. The 6AG7 is a fine little tube, but it is also prone to chirp if not properly disciplined. After smooth operation is confirmed, you may wish to add the optional crystal warping circuit shown in the inset in fig. 1. Suitable inductors and trimmer capacitors are available from Mouser Electronics and Antique Electronic Supply, and let you shift the transmitter's frequency 6 or 7 kHz.

Tune-up and operation of Stovepipe Annie is basically the same as any pi-net output transmitter. Connect an antenna, then tune the plate capacitor for minimum current/maximum output. Increase loading with the antenna capacitor until full output is achieved, and that's it. When fully loaded, plate current will be around 25 or 30 ma. As with most inexpensive '50s-style transmitters, a meter is not included in its assembly. You can add one in series with the key or the B+ lead, or use an SWR/wattmeter for tune-up as desired. Now start collecting parts and build your own copy of this little gem. You will love it!

Minnie Rush-Rush

Although commercially-made transceivers did not hit the amateur radio market until late in the 1950s, homebrewed transmitter-receiver units many folks called "rushboxes" set the stage for their evolution before that time. These one- and two-tube mini rigs were typically stuffed into small file boxes and powered

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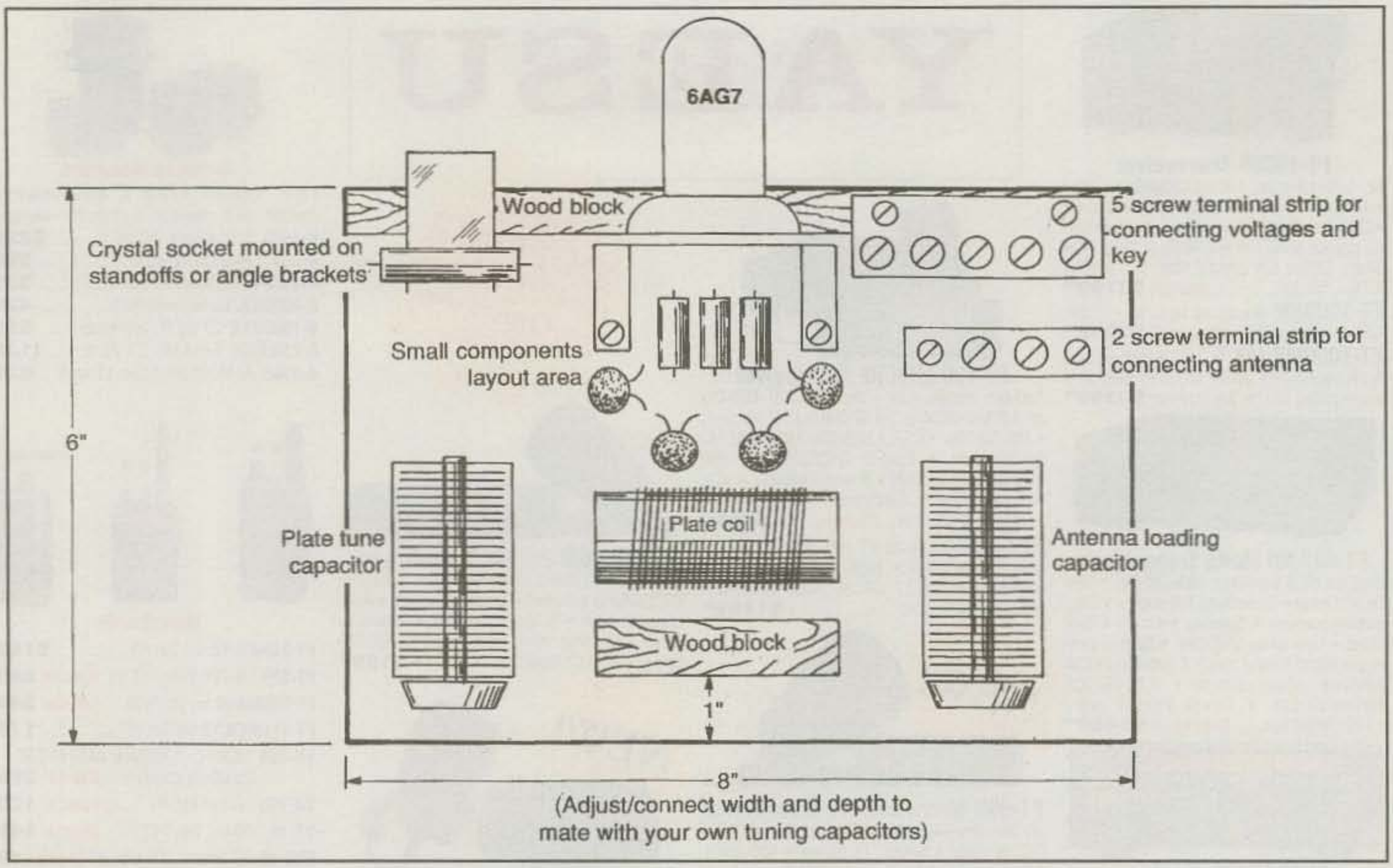

Fig. 2– Layout guide for components in the Stovepipe Annie transmitter. A modified breadboard arrangement is utilized, with the tube mounted horizontally and extending from the rear. (Discussion in text.)

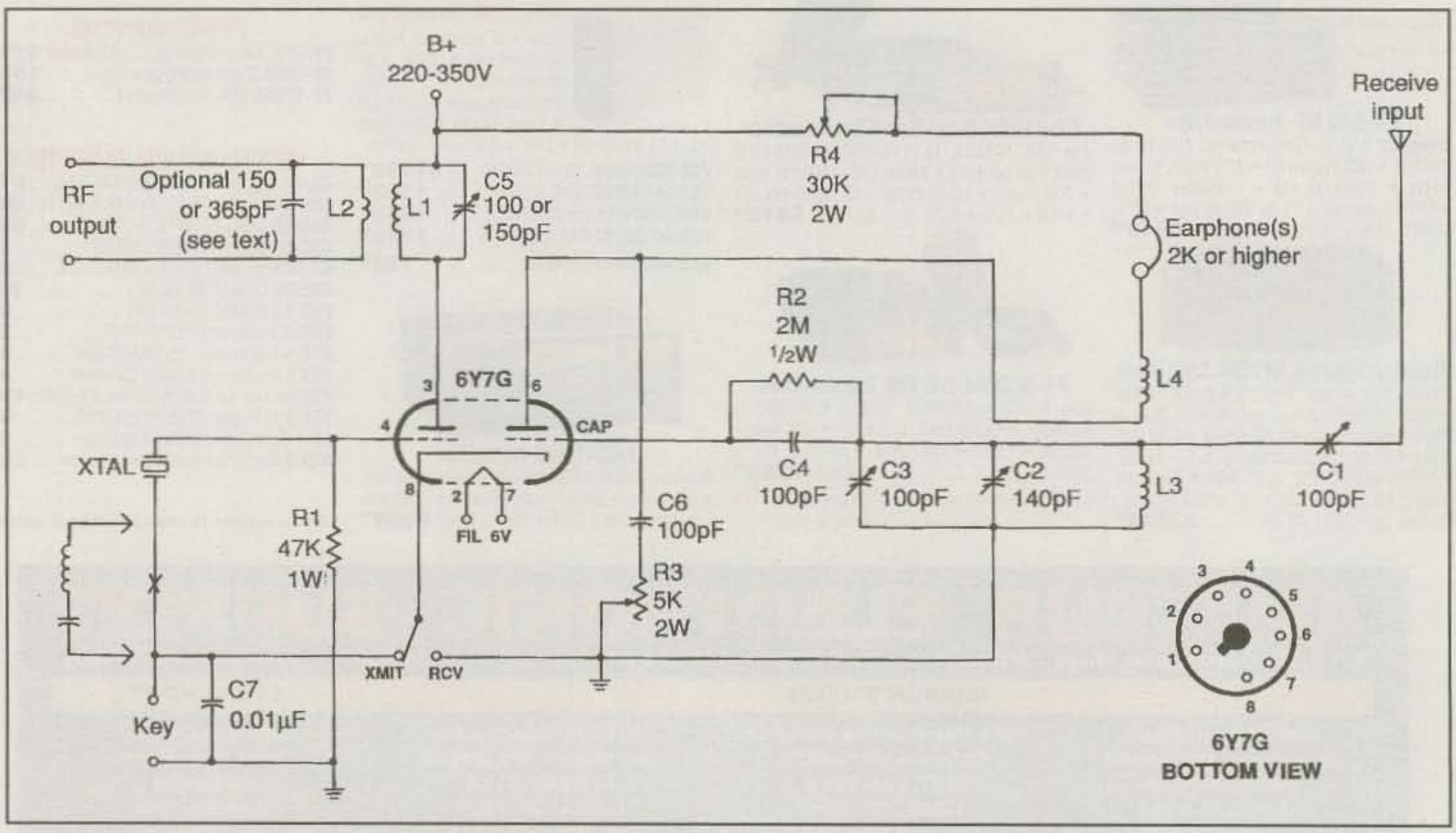

Fig. 3– Circuit diagram of the Minnie rush-rush trans-receiver. A single (two section) tube with T/R switching on its cathode serves double duty, acting as a regenerative detector on receive and a triode oscillator on transmit.

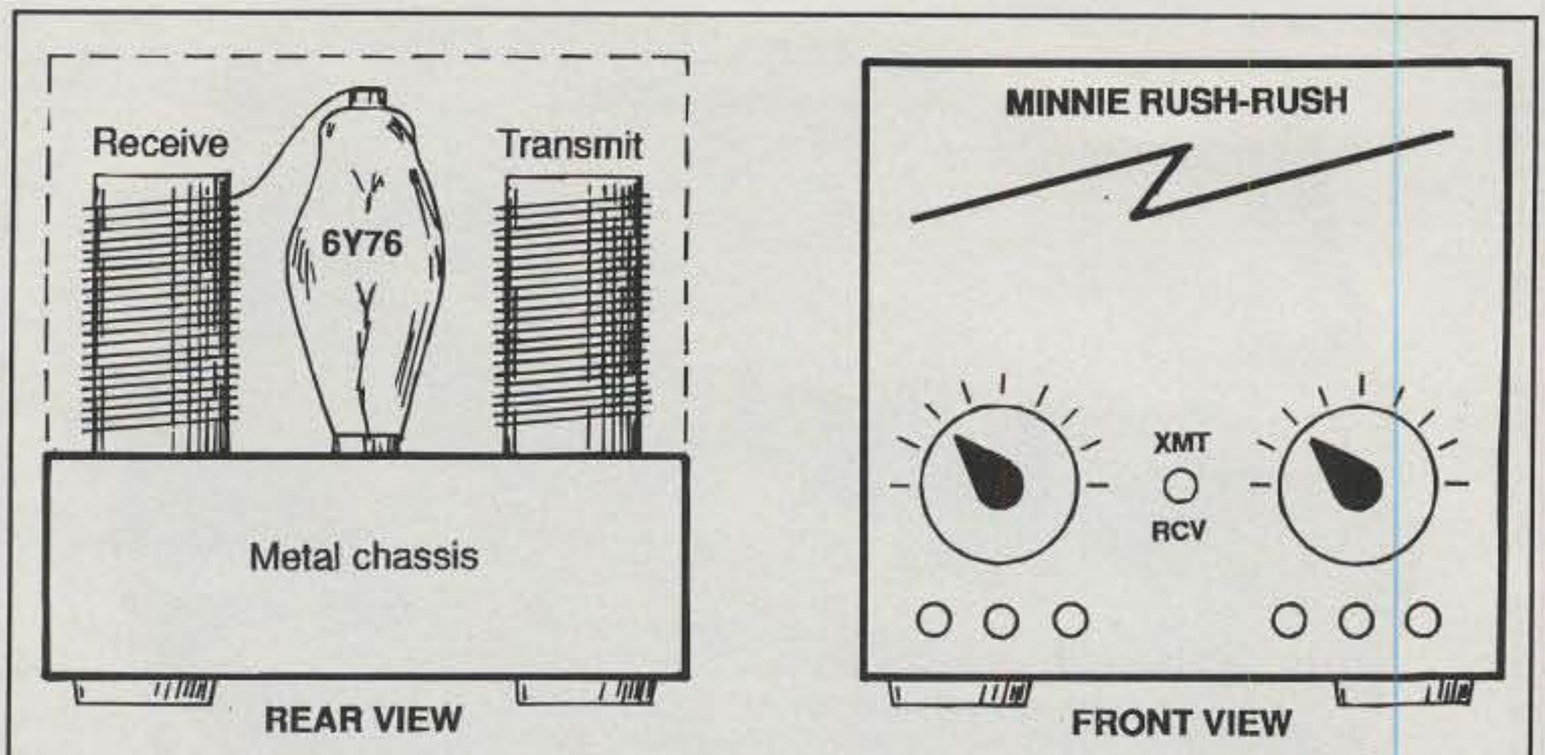

Fig. 4– Example of one way the Minnie rush-rush might be laid out/assembled on a small chassis or metal recipe box. The tube is positioned in the middle, with transmit and receive coils and circuitry for each section on their respective sides.

BAND	TRANSMITTER L1	TRANSMITTER L2	RECEIVER L3	RECEIVER L4
80m	28T, #22	15T, #22	35T, #30	10T, #30
40m	18T, #18	10T, #22	16T, #30	8T, #30
30m	13T, #18	8T, #22	8T, #30	5T, #30
	Space transmit coil L1 to 1½" long, 1½" diameter form. Close wind L2 below it.		Close wind coil L3 and L4 on 1½" diameter form. Wind L4 below L3.	

NOTE:
Wire sizes are not too critical. Substitutes are OK; see text.

Fig. 5– Coil data for the Minnie rush-rush. (Discussion in text.)

by batteries, and were used in portable operations during the early 1950s, throughout the 1940s, and even in the late 1930s. The first rushbox I recall seeing was built into a 3 by 5 inch metal recipe box, and it immediately stole my heart—just like miniature QRP transceivers steal everyone's heart today.

I am not sure why the critters were called "rushboxes." Maybe it was a result of the rushing noise their regenerative receiver made during operation, maybe it was because they could be assembled quickly, or maybe it evolved from the rush of excitement you felt when using one. Whatever the case, they are genuine fun rigs everyone can enjoy operating on the air today.

Bearing in mind that thought, one of the simplest and easiest to reproduce rushboxes I have seen is illustrated in figs. 3 and 4. This little tyke can be assembled for operation on 80, 40, or 30 meters, as desired. It is built around a twin-triode 6Y7G tube (or its dual-cathode equivalent, a 6F8G tube). One section of the tube is used as a regenerative detector/receiver driving an earphone, and the other section functions as a 3 or 4 watt output oscillator/transmitter. Each section has its own positive high-voltage connection and plug-in coil, and each section operates independent of the other. Shifting the 6Y7G's common cathode ground connection between transmit and receive sections serves as a T/R switch. If a dual-cathode 6F8G is used, incidentally, just lifting the receiver section's cathode above ground with a SPST switch is all that is necessary for T/R switching.

Now let's discuss some of the fine points in this rig's circuit diagram (fig. 3). First, the triode tube draws grid current during transmissions. A stout-hearted FT-243-type crystal (rather

than a fragile HC-8-type crystal) is thus recommended here. If you notice chirp, try reducing R1's value from 50K to 33K or 27K ohms. A midget variable tuning capacitor mounted to the (non-metal) chassis or panel may be used for C5, or you can substitute a small 100 pFd trimmer capacitor mounted in the top of the transmitter's coil form as desired. Likewise, a 150 or 365 pFd variable or trimmer capacitor can be added in parallel with the coil's output link for antenna loading if desired. The receiver section's grid-leak resistor and capacitor (R2 and C4) can also be coil form or chassis mounted as preferred. Coil mounting is good here because only a short wire can be routed to the tube's top grid cap. Separate grid-leak capacitors and resistors will then be required for each band, but the advantage is you can dink and optimize their values for each band.

Coils for both the transmitter and receiver sections are wound on 1 1/2 inch diameter plug-in forms (fig. 5), and wire size is not too critical. Even plastic-covered doorbell wire works fine, provided the transmitter's output can be peaked and the receiver will tune your desired range without their capacitors being set at fully open or fully meshed. Should that happen, just add or cut a couple of coil turns so resonance falls within tuning capacitor range. Remember this is a dink project and have fun.

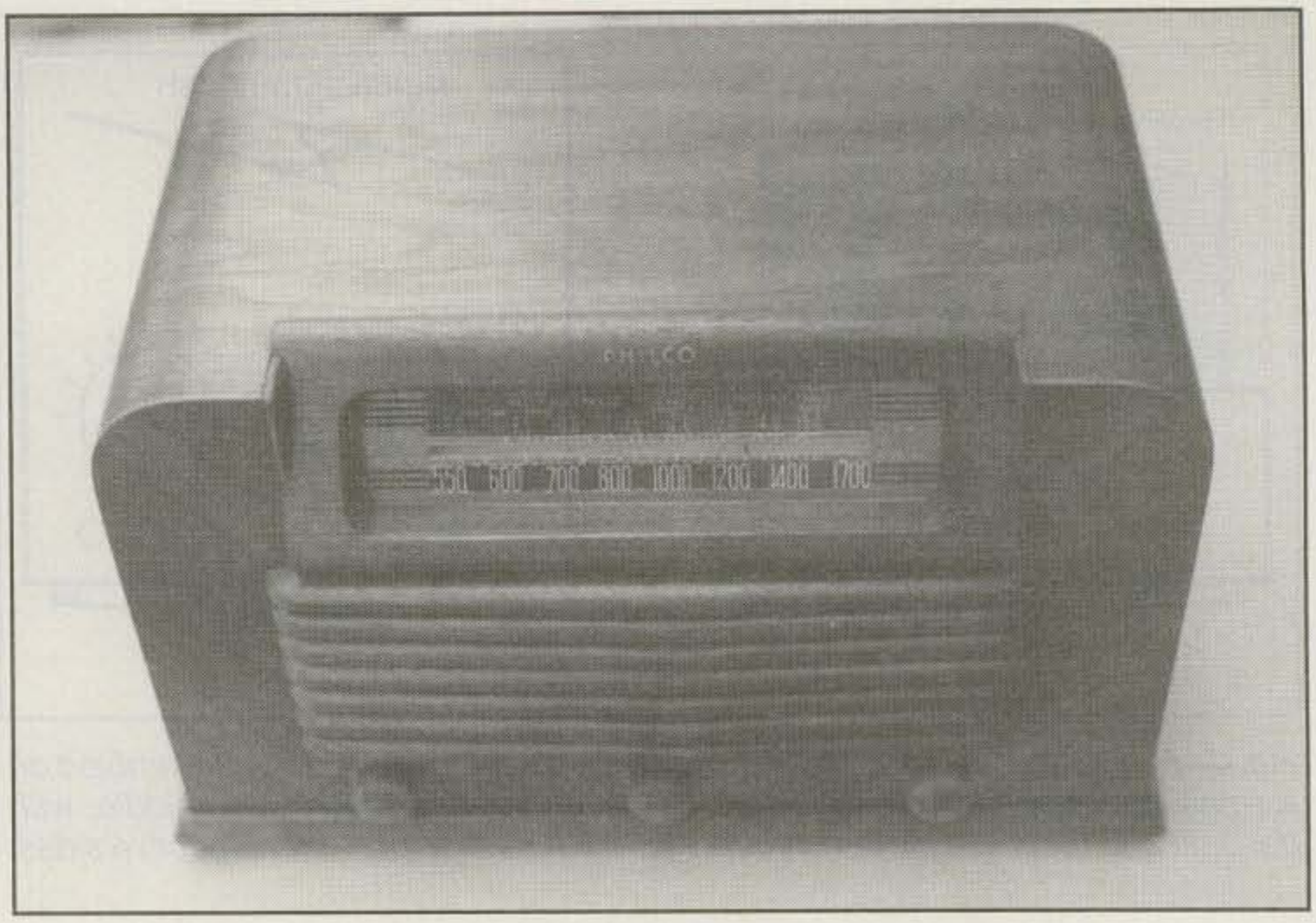

Photo B– Looking for a novel idea? Assemble the Minnie rush-rush on a defunct AM radio's chassis, include extra audio and RF amplifier stages, and you have a ham rig that looks like—a radio!

Originally, this trans-receiver was powered by three or four 75 or 90 volt "B" batteries and a 6 volt "A" battery for portability or operation down on the farm. You could home-brew a modern "B" battery equivalent from 25 to 30 nine volt batteries (whew!), or assemble a basic AC supply such as that used with Stovepipe Annie for this "Minnie." The receive will not require quite as much voltage, so just tap the battery bank or add a rheostat/pot in series with the earphone and adjust/set it so regeneration starts smoothly around a mid-range setting of R4. The earphone serves as a plate load for the receiver, incidentally, and thus should be an old-style 2K or 4K ohm item, and not a modern 8 ohm earphone.

I was hesitant to include an exact layout guide for Minnie, as her real personality lies in the way she is assembled and enclosed. This is where your creative ingenuity plays a major role. How so? Maybe you have a little wood '50s AM radio that is electrically a "basket case," but you haven't the heart to give it up. You could strip and clean its chassis, then build Minnie into three of its tube sockets. An extra stage or two of audio amplification could fill one or two remaining tube sockets (and drive the speaker), while a 6L6 amplifier stage could fill the other unused socket. A VXO circuit and antenna tuner could round out this "ham rig that looks like a home radio" project (photo B). It would be a real attention grabber everyone would envy!

Space is now very tight, so let's jump to tune-up and operating details. The transmitter's output coil/link is low impedance, and a good match for a dipole. Just insert a 50 or 100 ma meter in series with the key and tune the plate capacitor for a dip in current. The receiver's bandset capacitor (C3) is initially set to your approximate operating range, and then bandspread capacitor C2 is used for fine tuning. Normally, C1 is peaked for best reception with your selected antenna. Once set, readjustment is only necessary if a "dead spot" (caused by antenna "suckout") occurs in your receive range. Those tips should "getcha going" in fine style. Just remember not to short-sell Minnie. Three or four watts can work out thousands of miles (especially at this high point in the sunspot cycle), and regen receivers are remarkably sensitive. With a little luck, you might even make DXCC with Minnie before the end of the year! Go for it, and may the force of good signals be with you!

73, Dave, K4TWJ

As we cruise into the peak period of sunspot Cycle 23, we conclude our four-part series on the relationship between the Sun and the Earth, and its effects on radio communication, with N4XX's explanation of a new group of scales developed by the government to help keep track of space weather.

NOAA's New Space Weather Scales

BY DR. THEODORE J. COHEN,* N4XX

Table I – NOAA Space Weather Scale for Geomagnetic Storms

Category		Effect	Physical Measure	Aver. Freq. (1 cycle = 11 years)
Scale	**Descriptor**	**Some or all of these effects are possible**		
GEOMAGNETIC STORMS			**K_p values* determined every 3 hours**	**Number of storm events when Kp level was met (number of storm days)**
G 5	Extreme	*Power systems:* Grid systems can collapse and transformers experience damage *Spacecraft operations:* Extensive surface charging,, problems with orientation, uplinl/ downlink, and tracking satellites. *Other systems:* Pipeline currents reach hundreds of amps, HF (high frequency) radio propagation impossible in many areas for one to two days, satellite navigation degraded for days, low-frequency radio navigation out for hours, and the aurora seen as low as the equator.	$K_p = 9$	4 per cycle (4 days per cycle)
G 4	Severe	*Power systems:* Possible voltage stability problems, portions of grids collapse, and protective devices trip. *Spacecraft operations:* Experience surface charging and tracking problems, orientation oproblems need corrections. *Other systems:* Induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and the aurora seen as low as in the tropics.	$K_p = 8$, including a 9–	100 per cycle (60 days per cycle)
G 3	Strong	*Power systems:* Voltage corrections required, false alarms triggered on protection devices, and high "gas-in-oil" transformer readings likely. *Spacecraft operations:* Surface charging on satellite components, increased drag on satellite, and orientation problems need corrections. *Other systems:* Intermittent satellite navigation and low-frequency radio navigation problems, HF radio intermittent, and the aurora seen as low as mid-latitudes.	$K_p = 7$	200 per cycle (130 days per cycle)
G 2	Moderate	*Power systems:* High-latitude power systems affected. *Spacecraft operations:* Corrective actions are required by ground control; changes in drag affect orbit predictions. *Other systems:* HF radio propagation fades at higher latitudes, and the aurora seen as low as 50 degrees.	$K_p = 6$	600 per cycle (360 days per cycle)
G 1	Minor	*Power systems:* Weak power grid fluctuations. *Spacecraft operations:* Minor impact on satellite operations. *Other systems:* The aurora seen at high latitudes (60 degrees); migratory animals begin to be affected.	$K_p = 5$	1700 per cycle (900 days per cycle)

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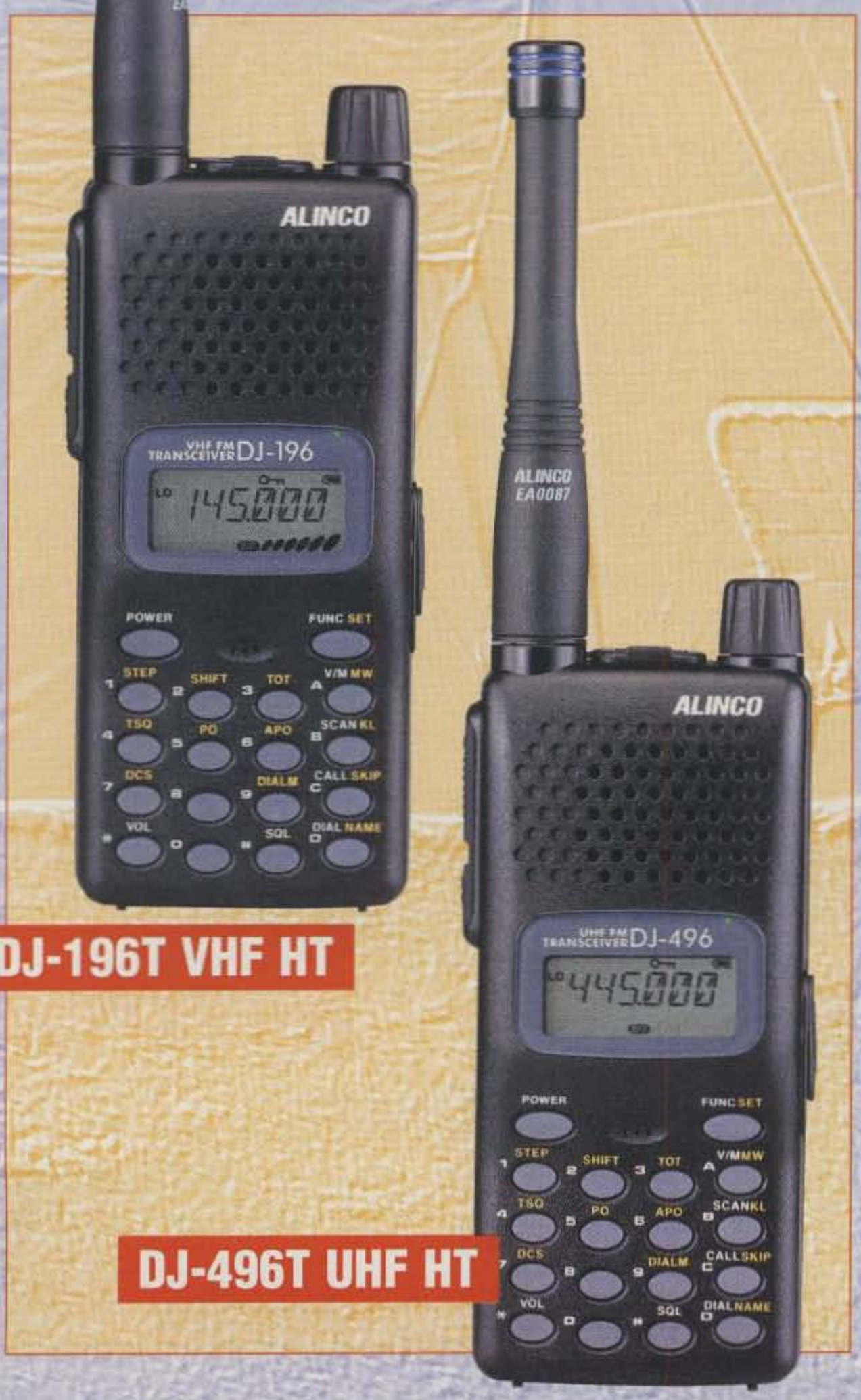

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In early November 1999 the National Oceanographic and Atmospheric Administration's (NOAA's) Space Environment Center (SEC) went public with three newly developed Space Weather Scales, one each for Geomagnetic Storms, Space Weather, and Radio Blackouts (Tables I, II, and III; these scales also may be found at <http://www.sec.noaa.gov/NOAAscales/index.html>). The scales are not unlike those used for years by weather forecasters, geophysicists, and others to gauge the intensity of hurricanes, tornadoes, and earthquakes. An important fact is that the new NOAA scales also give indications as to how often a given event is expected to occur and provide measures of intensity related to the physical and electrical effects observed. Note that in every case one cycle is equal to 11 years, the nominal period of the well-known sunspot cycle.

According to NOAA, the intent of the new scales is to assist the public in understanding space weather effects. Thus, the "plain language" descriptions in the scales is intended to be well suited to all users and to help the public keep abreast of current and expected space weather information.

A quick read of the scales yields some startling effects that might be observed over the next two to three years as the current sunspot cycle peaks, followed two years later by the expected peak in geomagnetic activity. For example, when the three-hour, planetary *K*-index (K_p) reaches a value of 9, which is expected to occur on 4 days every 11 years, and using the NOAA Geomag-

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Table II – NOAA Space Weather Scale for Solar Radiation Storms

Category		Effect	Physical Measure	Aver. Freq. (1 cycle = 11 years)
Scale	**Descriptor**	**Some or all of these effects are possible**		
SOLAR RADIATION STORMS			**Flux level of ≥ 10 MeV particles (ions)***	**Number of events when flux level was met (number of storm days**)**
S 5	Extreme	*Biological:* Unavoidable,high radiation hazard to astronauts on EVA (extra-vehicular activity); high radiation levels to passengers and crew in commercial jets at high latitudes (approximately 100 chest x-rays). *Satellite operations:* Loss of some satellites, memory impacts cause loss of control, serious noise in image data, star-trackers unable to locate sources; permanent damage to solar panels. *Other systems:* No HF (high frequency) communications possible in the polar regions, and position errors make navigation operations extremely difficult.	10^5	Fewer than 1 per cycle
S 4	Severe	*Biological:* Unavoidable radiation hazard to astronauts on EVA; elevated radiation exposure to passengers and crew in commercial jets at high latitudes (approximately ten chest x-rays). *Satellite operations:* Memory device problems, noise on imaging systems, star-trackers cause orientation problems, and solar panels degraded . *Other systems:* Blackout of HF radio communications through the polar cap and increased navigation errors over several days.	10^4	3 per cycle
S 3	Strong	*Biological:* Radiation hazard avoidance recommended astronauts on EVA; passengers and crew in commercial jets at high latitudes receive low-level radiation (approximately one chest x-ray). *Satellite operations:* Likely single-event upsets, noise in imaging systems, permanent damage to exposed components/detectors, and decrease of solar panel currents. *Other systems:* Degraded HF radio propagation through the polar cap and navigation position errors.	10^3	10 per cycle
S 2	Moderate	*Biological:* None. *Satellite operations:* Infrequent single-event upsets *Other systems:* Small effects on HF propagation through the polar cap and navigation at the polar cap impacted.	10^2	25 per cycle
S 1	Minor	*Biological:* None. *Satellite operations:* None *Other systems:* Minor impacts on HF radio in the polar regions.	10	50 per cycle

** Flux levels are 5 minute averages. Flux in particles·s^{-1}·ster^{-1}·cm^{-2}*

*** These events can last more than one day.*

Table III – NOAA Space Weather Scale for Radio Blackouts

Category years)		Effect	Physical Measure	Aver. Freq. (1 cycle = 1
Scale	**Descriptor**	**Some or all of these effects are possible**		
RADIO BLACKOUTS			**GOES X-ray peak brightness by class (and by flux*)**	**Number of events when flux level was met (number of storm days)**
R 5	Extreme	*HF radio:* Complete HF (high frequency) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. No HF radio contact with mariners or en route aviators. *Navigation:* Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 (2×10^{-3})	Less than 1 per cycle
R 4	Severe	*HF radio:* HF radio communication blackout for one to two hours on most of the sunlit side of Earth. HF radio contact lost during his time for mariners and en route aviators. *Navigation:* Outages of low-frequency navigation signals cause increased error in positioning for mariners and general aviators for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 (10^{-3})	8 per cycle (8 days per cycle)
R 3	Strong	*HF radio:* Wide area blackout of HF radio communication signals, loss of radio contact for mariners and en route aviators for about an hour on sunlit side of Earth. *Navigation:* Low-frequency navigation signals degraded for about an hour, affecting maritime and general aviation positioning.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	Moderate	*HF radio:* Limited blackout of HF radio communication signals on sunlit side, loss of radio contact for tens of minutes for mariners and en route aviators. *Navigation:* Degradation of low-frequency navigation signals for tens of minutes affecting maritime and general aviation positioning.	M5 (5×10^{-5})	350 per cycle cycle (300 days per cycle)
R 1	Minor	*HF radio:* Weak or minor degradation of HF radio communication signals on sunlit side, occasional loss of radio contact for mariners and enroute aviators. *Navigation:* Low-frequency navigation signals degraded for brief intervals affecting maritime and general aviation positioning.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

** Flux, measured in the 0.1-0.8 nm range, in W·m-2.*

netic Storms scale, (1) power grid systems can collapse, (2) HF radio propagation will be impossible in many areas for one to two days, and (3) aurora will be seen as low as the equator. Now, such a G5 event will really be something to experience! Similar scales for solar radiation and X-ray peak brightness provide equally enlightening descriptions of effects that may be observed.

Taken together, the new NOAA scales will be a helpful communication tool to help the general public understand the space weather effects with which radio amateurs and other users of the radio spectrum already are very familiar. For more information on the relationship between the Sun and the Earth and how that interaction affects radio communication, see the first three installments in this series, "Uncle Sol's Solar Wind and the Earth's Magnificent Magnetosphere," Parts I and II, by Karl Thurber, W8FX (August and September *CQ*) and "Measuring Geomagnetic 'Weather,'" by Ken Neubeck, WB2AMU (elsewhere in this issue). ■

What's New

BY KARL T. THURBER, JR., W8FX

A New Column for A New Century

Fall Goodies for the Radio Shack

This month in your "What's New" column we'll focus on a new top-of-the line radio by Grundig, keys and paddles, rotating tower products, mobile goodies, and several new books on antennas and radio waves. Ready? Let's begin by turning first to a popular German import.

Grundig's New Top-of-the-Line Radio

Radio amateurs usually are concerned with shortwave communications receivers, not just "any old radio." As we amateurs know, a communications receiver is considerably more than just a consumer appliance. Rather, it's an advanced device that receives a variety of signals (such as AM, CW, SSB, SSB, RTTY, and possibly FM and various digital modes), often under difficult conditions. Modern communications receivers usually are of the "tabletop variety" and are offered by manufacturers such as Yaesu, Drake, AOR, Japan Radio, ICOM, Kenwood, and several others.

Today, however, some high-end "world band" portable or "portatop" sets seek to qualify as communications receivers. Excellent-quality portables and portatops are offered by makers such as Sangean, Grundig, Sony, Panasonic, and others. The German manufacturer Grundig, in particular, long has been at the forefront of serious shortwave radio manufacturers, especially with its top-of-the-line Satellit series radios.

The latest, and arguably greatest, radio in the series is the Grundig Satellit 800 Millennium. The radio was engineered in partnership with the R. L. Drake Company, a name very familiar to radio amateurs. The new Grundig radio covers the AM and shortwave bands continuously from 100 kHz to 30 MHz, VHF aircraft from 118–137 MHz, and FM/stereo from 87–108 MHz. The Grundig radio features an analog S-meter; a large (6" × 3 1/2") LCD display that shows every operating function; automatic gain control (AGC) in two modes, fast and slow; synchronous signal detection; dual user clocks; 70 user-set station memories; a pair of high-quality stereo headphones; and more. The radio has a list price of $699.95, but it generally is available on the street for around $500.

A top-notch Grundig shortwave radio is the new Satellit 800 Millennium, which was engineered in partnership with the R. L. Drake Company. The new radio continuously covers the AM and shortwave bands from 100 kHz to 30 MHz, VHF aircraft from 118–137 MHz, and FM/stereo from 87–108 MHz. Picture one of these "portatops" on your desktop or nightstand! (Photo courtesy Lextronix/Grundig)

For more details, contact Lextronix/Grundig, 3520 Haven Avenue, Unit L, Redwood City, CA 94063-4605 (1-800-872-2228; on the web: <http://www.grundigradio.net>).

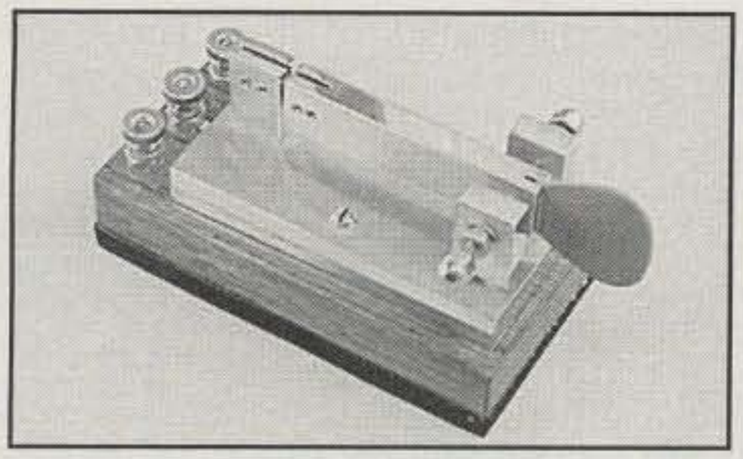
Keys, Paddles, and More

Finger Tappers™ Keys. In the July 1996 column we profiled two Milestone Technologies products. They were M*LOG™ and CODEMASTER V™. M*LOG was full-featured radio logging software for amateurs and SWLs to automate their logkeeping functions. CODEMASTER V taught Morse Code in a flexible, but structured environment that helped users significantly improve their copying skills by offering various forms of Morse Code practice with fully adjustable parameters. Now, under the Morse Express name, Marshall Emm, N1FN, offers a new Straight Key as well as a Single Lever Paddle, both of which are made by Jim Richards, KD6VDH. Each of these is priced at $99.95. The Straight Key is a medium-size key machined from solid-brass stock and mounted on a polished hardwood base with a rubber pad underneath. The device is quite heavy (14 oz.), and has an unusual but very comfortable knob. The knob has a brass cap and a wood base.

A close companion to the Straight Key, the Single Lever Paddle is a classic, machined-brass-on-wood design. Similar in design and materials to the Straight Key, it has the same dimensions and weight. You can adjust contact spacing precisely for a light touch.

The Finger Tappers™ Straight Key is a medium-size key machined from solid-brass stock and mounted on a polished hardwood base with a rubber pad underneath. The device is quite heavy (14 oz.), and it has an unusual but very comfortable knob. The knob has a brass cap and a wood base. (Photo from MorseX/Milestone Technologies website)

*289 Poplar Drive, Millbrook, AL 35054-1674
e-mail: <w8fx@cq-amateur-radio.com>



A close companion to the Straight Key, the new Finger Tappers™ Single Lever Paddle is a classic, machined brass-on-wood design. Similar in design and materials to the straight key, the paddle has the same dimensions and weight. You can adjust contact spacing precisely for a light touch. Both keys are built by Jim Richards, KD6VDH. (Photo from the MorseX/ Milestone Technologies website)

Marshall adds that he now has over 85 different keys, bugs, and paddles, representing what he says is the broadest inventory of such equipment ever assembled by one organization. In fact, he says that his sales of keys last year makes him the biggest telegraphy retailer in the world!

Various other Morse -related products are available, including the original Swedish Pump Key. Marshall notes that while it's a massive instrument, one that is well-suited to the European keying style, it's nevertheless a delight for anyone to use.

For more information, contact Morse Express, a division of Milestone Technologies, Inc., 2460 S. Moline Way, Aurora, CO 80014 (1-800-238-8205; on the web: <http://www.morseX.com>; e-mail: <nifn@MorseX.com>).

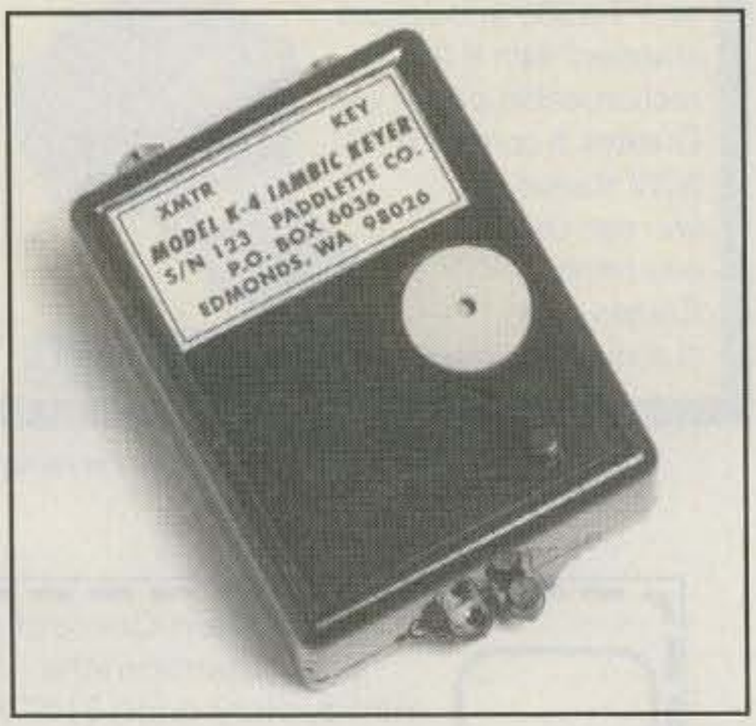
Morse Mate de ZS6KR. Hans Kappelin, ZS6KR, writes that he has been a *CQ* reader for over 20 years, and he's pleased with the move to include *CQ VHF* in the new and expanded *CQ*.

As an electronics engineer as well as a keen CW operator and DXer, Hans has devised several Morse readers over the years. Recently, he brought to our attention one of his commercially available units, one he offers in both kit and ready-made form. Hans says his Morse Mate is an excellent teaching aid that encourages correct sending discipline. It is a compact CW decoder and keyer combination, a stand-alone unit with a large, 16-character LCD display; it doesn't require a PC. Besides the CW decoder with display, the unit has a keying section with programmable options and an audio processing section to handle the output of a receiver. Instructions and technical data are provided with every

unit. Price is $125 U.S. for the ready-made unit, or $100 for the kit, including foreign shipping from South Africa.

Information and online ordering are available from Hans, ZS6KR, of QRV Technology, 1250 Barret St., Queenswood, Pretoria 0186, Rep. of South Africa (telephone +27 12 333 2612; on the web: <http://www.scyden.co.za/qrv/morsemate.html>; e-mail: <hans@smartnet.co.za>).

Paddlette High Performance K-4 Iambic Keyer. While we're still on the general subject of Morse Code sending and receiving, we should mention that Bob Hammond, KI7VY, of Paddlette Co., offers several compact paddle keys for the discriminating CW enthusiast. They come in different flavors, several of which we profiled in the May column. These included the basic Paddlette, as well as the Models KP-1 and KP-3.



Bob Hammond, KI7VY, of Paddlette Co., offers several compact paddle keys for the discriminating CW enthusiast. He recently introduced the Model K-4 Iambic Keyer. Housed in a tiny black box and weighing just an ounce, the K-4 is said to outperform keyers many times its size and weight. The unit will operate for four years on the self-contained lithium coin cell. (Photo courtesy Paddlette Co.)

Now Bob tells us he has introduced the Model K-4 Iambic Keyer. Housed in a tiny black box and weighing just an ounce, the K-4 is said to outperform keyers many times its size and weight. The unit will operate for four years on the self-contained lithium coin cell.

Basically, the K-4 generates strings of "dits" and "dahs" in response to paddle strokes. It also offers a menu of 12 keying options. The unit features non-volatile memory for speed, mode, paddle select, and sidetone on/off control. It contains the latest TiCK-4 CMOS keyer IC, as well as input and output jacks and the lithium battery. The K-4 is designed to key any normal solid- state transceiver. It's $48.95 plus $2.25 shipping by first-class mail.

For details on the K-4 Iambic Keyer and other Paddlette products, contact Paddlette Co., P.O. Box 6036, Edmonds, WA 98026 (425-743-1429; e-mail: <bham379627@aol.com>; on the web: <http://home.att.net/~goodroe/paddlette>).

Rotating Tower Systems Changes Hands

In several columns, most recently in December 1992, we profiled the intriguing and popular towers offered by Rotating Tower Systems and its proprietor, Dick Weber, K5IU. Dick recently surprised us with the announcement that his company has changed hands.

The new proprietor is Paul Nyland, K7PN, of Welches, Oregon. Paul is the owner of Custom Metal Works, which provides amateurs with professionally built tower components, antenna side mounts, and custom Yagis, as well as professional tower erection and antenna installation services. Paul is no stranger to rotating towers, having installed some of the most aggressive rotating tower installations in the US.

The rotating tower concept lets you effectively multiply your "tower real estate" to efficiently and flexibly rotate stacked arrays. It does this through the use of a rotating base that can be installed at practically any height, along with appropriate sets of guy-wire bearings. The main advantages include easy stacking of antennas, positioning multiple antennas at their optimum heights, and combining various bands (VHF, UHF, and HF) on a common tower having a single means of rotation. Of course, all this means less room being required for the installation.

While the initial cost of a rotating tower is high, the ability to handle multiple antennas with one tower, rotator, guy wires, anchors, and cable set allows the rotating tower to become a competitive option. It's also not as hard to erect a single tower as it is to put up several. For a more recent look at these towers, see W8CM's article "Turn the Tower, Hold the Antennas," on page 52 of the July 2000 issue of *CQ*.

We wish Paul the best of luck. For more information on the products and services offered by his firm, contact Paul Nyland, K7PN, at Custom Metal Works, P.O. Box 371, Welches, OR 97067 (phone 503-622-4403; web: <http://

www.custommetalworks.com>; e-mail: <paul@custommetalworks.com>).

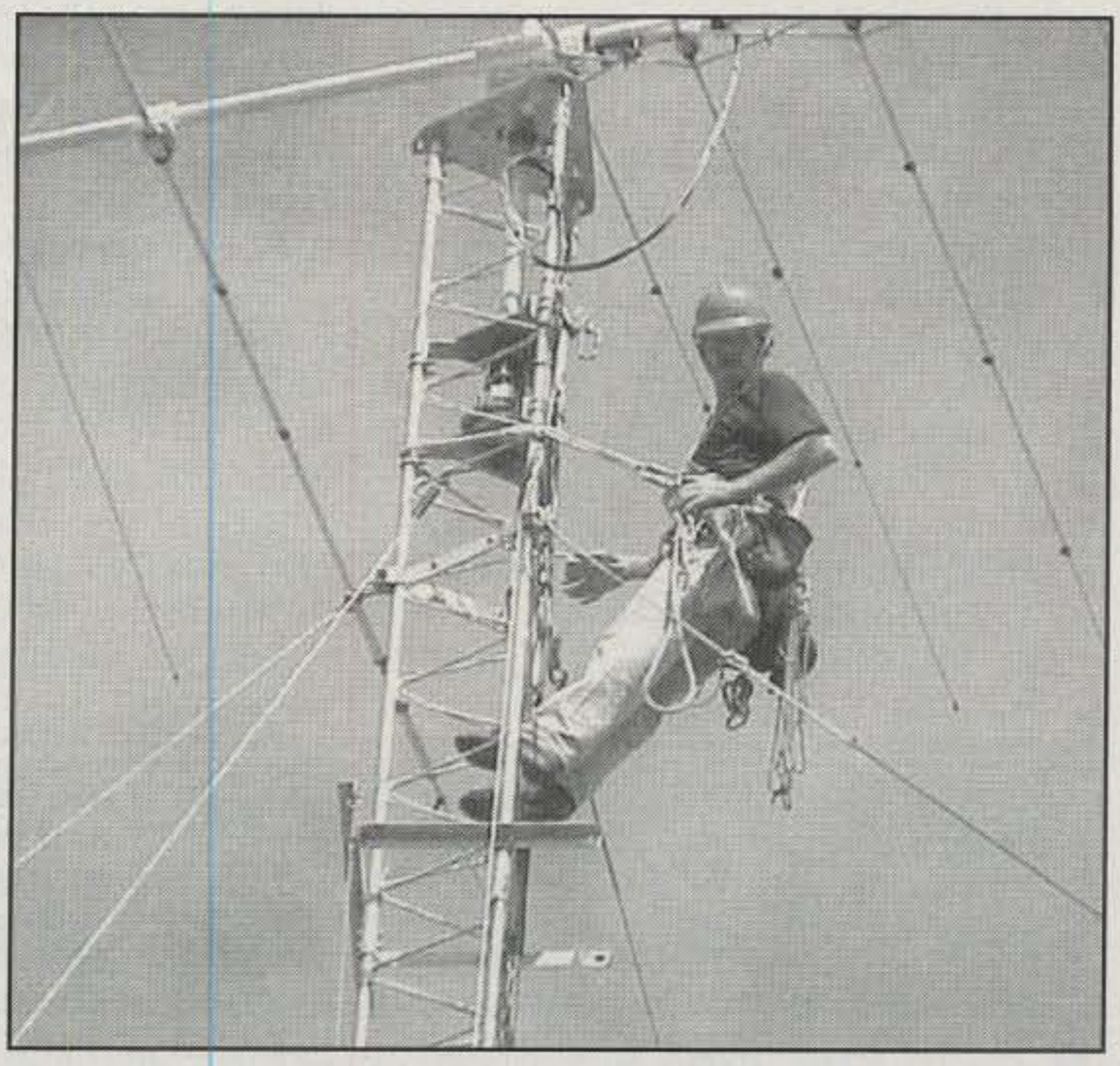
Portable and Mobile Goodies

SAM™ Screwdriver Antenna Memory. SAM, the Screwdriver Antenna Memory system, looks like a product whose time has come. It's designed by Dane Westvik, KO6YD, to enhance the class of mobile antennas commonly called the "Screwdriver."

The SAM system adds a tuning preset feature to the antenna by effectively replacing the manual control switch. The unit, which is just 2"H × 4"W × 4"D, offers 16 memories for saving antenna coil position information. SAM features a two-digit display for memory and mode information, "jog mode" for fine tuning, VFO-style knob for selection and fine tuning, and a built-in ICOM 706 Tune Controller.

At the heart of SAM is a small microprocessor that controls the up-and-down movement of the antenna and tracks the antenna coil position. This position can be saved to one of 16 nonvolatile memories for later recall. The sensing operation at the antenna is achieved by attaching a small magnet

W&W Manufacturing Co. is a domestic manufacturer of replacement battery packs, inserts, chargers, analyzers, and battery eliminators. Besides the amateur radio market, the firm also supplies laptop, camcorder, cell phone, radio, and other specialized batteries for a variety of commercial and home users. The photo shows replacement NiCD and NiMH batteries for the popular commercial Motorola HT750 handheld transceiver. (Photo courtesy W&W Manufacturing. Co.



Here's one example of a completed Rotating Tower Systems "antenna farm" project at the QTH of George Cutsogeorge, W2VJN, Umpqua, Oregon. The installation sports a variety of HF antennas, including two 4/4 20 meter Yagis fixed on Japan. New proprietor Paul Nyland, K7PN, of Custom Metal Works, is shown in this photo installing one of the 4-element, 20 meter Yagis. (Photo from the Custom Metal Works website)

onto the internal shaft. The sensor is attached to the outer tube of the antenna, or internally if space permits. This sensor is connected to the SAM unit.

You operate the SAM system by using a VFO-style knob with integrated pushbutton and a separate Mode pushbutton. The knob is used to select a preset channel and to "jog" the antenna position for fine tuning. The Mode button is used to select the various operating modes. With this innovative system, mobile antenna tuning can be a much-welcomed one-handed operation.

Sound complicated? Not really. Check out the SAM web page for details, or send for a flyer that explains the circuit and how to connect it to the antenna. Contact KO6YD Designs, P.O. Box 1090, Elverta, CA 95626 (916-728-4359; web: <http://www.ko6yd.com>; e-mail: <info@ko6yd.com>).

W&W Manufacturing Company Batteries. W&W Manufacturing Co. is a domestic manufacturer of replacement battery packs, inserts, chargers, analyzers, and battery eliminators. Besides the amateur radio market, the firm also supplies laptop, camcorder, cell phone, radio, and other specialized batteries to a variety of commercial and home users.

In addition to the extensive line of specialized batteries and accessories offered by the firm, they also have both standard and ultra-high capacity NiMH communication batteries, available for a variety of amateur radio transceivers. The accompanying shows sample replacement NiCD and NiMH batteries for the commercial Motorola HT750 handheld two-way radio.

For more information on batteries and other battery-related products, contact W&W Manufacturing Co., 800 South Broadway, Hicksville, NY 11801-5017 (1-800-221-0732; on the web: <http://www.wwassociates.com> or <http://www.wwmanufacturing.com>; e-mail: <w-wassoc@ix.netcom.com>).

From the Bookshelf

Two from MAX Research. Antennas and radio waves are unraveled for you in two new books by John Bosco, KA2ASK, of MAX Research. John's goal in writing the books is to make the theories of the pioneers of radio both readable and enjoyable. The first book is *The Science of Antennas*. The book contains 105 pages of comprehensive material explaining just why antennas radiate and receive. Topics include electron effects, radiation and wave theory, reception concepts, radio frequency phenomena, and the special contributions of electronics pioneers Faraday and Maxwell. It is $14.95 postpaid.

The second book is *Antenna System Optimization*. In it the principles of antenna system optimization are explained, and the reader is shown how to get the most signal into or out of his or her antenna. The book's 80 pages cover a variety of topics, including elementary wave theory, the theory of transmission lines, and grounds. It also is $14.95 postpaid.

John adds that these books are not "run of the mill" antenna books in that they delve quite deeply into the "whys" of antennas. Most of all, he notes that the books are written to ignite the spirit of those radio amateurs who want to experiment, tinker, and invent.

For ordering or for more information, contact MAX Research, Group AR, P.O. Box 1306, East Northport, NY 11731.

Wrap-Up

That's all for this time, gang. Next time more "What's New." See you then.

Overheard: One thing I have learned is that no matter how intelligent you think you are, you always can learn things from others.

73, Karl, W8FX

University of Surrey in England. The much-anticipated launch of this most-sophisticated-ever ham satellite has been repeatedly delayed.

Three smaller ham satellites were scheduled for launch in late August, including the first-ever ham satellites built in Saudi Arabia and Malaysia. All three were slated to travel to orbit together from the Baikonur Cosmodrome in Kazakhstan. The two Saudi satellites, SAUDISAT-1A and 1B, will be 9600-baud digital "birds" with FM capability as well. Their downlinks will be in the 70 cm band, with uplinks on 2 meters. Malaysia's TIUNGSAT-1 will be a digital-only satellite, with speeds up to 76,800 bits per second (yes, that's faster than your 56k modem). Like the Saudiats, it will have uplinks on 2 meters and downlinks on 70 cm. TIUNGSAT will also carry non-amateur earth-imaging payloads.

"Cluster" Satellites Launched To Study Magnetosphere

A quartet of satellites known collectively as "Cluster" has been successfully launched in two separate liftoffs. The first pair was launched on July 16 and the second on August 9, all from Kazakhstan. The four satellites will arrange themselves in a tetrahedral (triangular pyramid) formation, according to NASA, for the purpose of creating three-dimensional images of activity in the Earth's magnetic field. Earth's magnetic field and its interaction with the solar wind are responsible for auroras and most likely for the ionization of the ionosphere, making the findings of these satellites of great interest to many hams. Cluster is a European Space Agency program designed to work in cooperation with NASA's SOHO satellite (see last month's story on the solar wind for more on SOHO).

Canadian Ham Group Seeks Single Code Speed

Canada's national ham radio association has petitioned its government for a single, 5-word-per-minute code exam for all levels of amateur license. The Radio Amateurs of Canada (RAC) has asked Industry Canada, which regulates telecommunications there, to drop the 12 wpm test currently required for full amateur privileges, and to extend those privileges to any amateur who has passed a 5 wpm exam.

According to RAC, the request also asked for more comprehensive written exams, focusing on station setup and operation, on-air procedures and operating practices, and modern modes of amateur communication. The RAC said the decision by its board of directors came after considerable consultation with members, and a conclusion that the majority of Canadian hams support lowering the code test speed. There has been no response so far from Industry Canada.

FCC to Kenwood: Sky Command is Illegal

The FCC has denied Kenwood Communications' request for a declaratory ruling that its innovative Sky Command system for remotely controlling HF transceivers is legal. In fact, said Wireless Telecommunications Bureau Chief D'Wana Terry in an order issued in late July, the system is illegal as currently configured because it uses an auxiliary link in the 2 meter band, where auxiliary operation is not permitted.

The system allows users of certain Kenwood dualband handhelds to remotely control similarly equipped Kenwood HF rigs, with transmit audio and control tones transmitted on 440 MHz—where auxiliary operation is allowed—and receive audio from the HF rig retransmitted to the HT on 2 meters. Kenwood had argued that this return link did not constitute auxiliary operation, as it was audio only. Terry disagreed, noting that the received audio was the control operator's only source of information about retuning or even shutting down the HF radio. The order also denied Kenwood's "backup" request for a waiver, but did not address the request made by the company in its reply comments that, if neither of its initial requests were granted, that the filing be considered as a petition for rule making to change the auxiliary operation rules.

At press time Kenwood had not decided what action, if any, it would take next in this matter, but indicated that it had stopped selling the interconnecting cables needed to make the system work.

FCC Adds to Alphabet Soup

Amid an overwhelming lack of response by hams to its new Universal Licensing System (ULS), the Federal Communications Commission (FCC) has unveiled the Commission Registration System (CORES), which is ultimately supposed to replace ULS. People signing up with CORES will receive a unique 10-digit FCC Registration Number (FRN) to be used on all future applications. According to the FCC, those who registered in ULS before June 22 would automatically be registered in CORES and would receive their FRN in the mail. One may also search for one's FRN online at the FCC's CORES website (we don't have the URL, so just go to <www.fcc.go> and search for CORES).

Meanwhile, calculations by both Volunteer Examiners and the FCC indicate that only between 18 and 19% of all hams have registered with ULS. Registration is required in order to process any sort of application with the FCC, but some hams have resisted, protesting the requirement that they provide their Taxpayer Identification Number (TIN), better known as their Social Security Number, as part of the process. According to the *ARRL Letter,* the FCC insists it is required by law to collect this information.

The FCC has not speculated on other reasons for the low registration rate, but we will: It's likely that most hams simply haven't had the need to "do business" with the FCC since the system came online last year, and will wait until it's time to renew, upgrade, or file some other application before registering. FCC officials say registering now will protect you from accidentally having your callsign deleted or reissued due to a filing error.

Arkansas Repeater Owner Told Interference Prevention is His Job

FCC amateur enforcement chief Riley Hollingsworth, K4ZDH, has told the licensee of an Arkansas repeater that since he cannot prove his repeater is coordinated, it is his sole responsibility to resolve and prevent interference problems with a nearby coordinated repeater. In a letter to Tom Lee, AC5RU, Hollingsworth said a letter from the repeater coordinator indicated that Lee had lost his original coordination by moving his repeater several times, and that another repeater had been coordinated on the frequencies of Lee's repeater. Reminding Lee of the rules' provision that when there is interference between coordinated and uncoordinated repeaters "the licensee of the uncoordinated repeater has primary responsibility to resolve the interference," Hollingsworth concluded, "Inasmuch as you are unable to demonstrate coordination, you are responsible for preventing interference to the coordinated repeater system..."

Additional and updated news is available on the Ham Radio News page of the CQ website at <http://www.cq-amateur-radio.com>. For breaking news stories, plus info on additional items of interest, sign up for CQ's free online newsletter service. Just click on "CQ Newsletter" on the home page of our website.

Public Service

BY BOB JOSUWEIT, WA3PZO

Public Service and Emergency Communications

Field Day: It's All About Teamwork and Having Fun!

Our June article on message handling for Field Day prompted several positive responses. This month we loosen up a bit to remember Field Day 2000 and show our appreciation for those who made it happen.

Each year hams go out into the field to practice emergency communications. For many it's the closest they'll ever come to a "real" emergency. However, when the end of June comes around, they are ready to go. And as with any emergency or public-service communications effort, it's not the work of one person that makes the event a success; it's the work of many. Each person has a different skill to contribute to the group.

Many clubs spend a month or more preparing for Field Day. Like many clubs, the Mid-Atlantic Amateur Radio Club in suburban Philadelphia does not participate in Field Day to compete against other clubs. There are plenty of other events for those who enjoy hard-core contesting. MARC does Field Day to learn and practice all sorts of skills, to get to know each other better, and to enjoy ham radio in an outdoor setting. Nobody is there to show off. Nobody is there to make beginners feel all thumbs. In all the years of MARC's participation in Field Day there has never been a single participant who knew it all.

In Montana several clubs got together for Field Day. Dawn Peterson-Smith, KD7FMT, an Assistant Emergency Coordinator, was very enthusiastic about all of the clubs getting together. She said, "The exchange of information between those who are new to the hobby and emergency communications, and those with experience in said areas is critical *before* an incident occurs. This would be the perfect opportunity for this!"

Just what are some of those skills? Let's start early on. Any event takes planning and coordination. One of the tasks is locating a good site. It has to be a place that's easily accessible and has plenty of space, trees for antennas, an area in which to cook, no poison ivy, and if you're lucky, is close enough to a store for when you realize you forgot to put something in the car. Every operating position requires shelter, lighting, tables, and chairs. Someone has to make sure that every radio system will be operational. This includes having the basics—a radio, SWR meter, and antenna tuner—and also the little items, such as a coax jumper cable, a barrel connector to join two pieces of coax together, and an adapter for the headphones. It also includes being able to reach over for a soldering iron when a wire comes loose.

Mike Wurgley,N3LXN, gets ready to place a rope high in the trees at the Holmesburg Amateur Radio Club Field Day site in Jenkintown, Pennsylvania. (Photo by WA3PZO)

Sun-Air Aviation's helicopter helps Field Day participants raise the antenna at the airport in Camarillo, California. (Photo courtesy Greg Schultz, N6IAF)

The Tucson (Arizona) IBM Amateur Radio Club posted a couple of pre-event planning lists on their web site. Does your club or group public-service event list come close to this?

Power: Generator (primary and back-up), fuel tank for generator, 5 gallon cans of fuel, siphon hose (to get fuel from a car, if necessary), funnel for fueling generator, oil for generator, natural power source (solar panel, regulator, battery, etc.), extension cords, multi-outlet adapters, fire extinguisher, and power-line monitor.

Transceiver and Power: Transceiver operating manual, spare fuses for equipment, desk microphone, microphone/headset, Y-connector for dual headset, second headset for logger, keyer and paddle, foot switch, DSP filter, coax cable (100 ft.), coax patch cables/short cables, twin-lead feeder, 4:1 balun, 40 meter dipole, 15 meter bi-square antenna and associated ropes, coax stub filters, antenna tuner/coax switch/SWR bridge, TNC, power supply, DC cable, serial cable, radio cables, logging computer setup, operating tent, large tarp for extra shade/rain-proofing, chairs, fan, table for equipment, desk lamp and spare bulbs, battery-operated clock, and an outside "porch" light.

Miscellaneous: Field Day package, any external publicity, W1AW message and schedule, message pad, emergency contact via cell phone, common hand tools, sledge hammer, multimeter, antenna analyzer, electrical tape, soldering gun and solder, small soldering iron, hook-up wire, RFI ferrites, first-aid kit, club signs/banners, four Field Day binders (for operating guide, section list, W1AW bulletin schedule, frequency allocation list, repeater access instructions, tuner settings, Forest Service permission, logger instructions, FD problems/notes sheets, log sheets, operator schedule and sign-in sheet), pens and pencils, clipboards, scratch paper, broom, coax connectors,

c/o CQ magazine
e-mail: <wa3pzo@cq-amateur-radio.com>

Communications Hints and Instructions

In July, 150 Georgia hams supplied communications for the 2000 Georgia Games. The sporting event took place at 35 different locations. David Ziskind, KE4QLH, of Atlanta, Georgia coordinated the communication efforts. Ziskind, 18, was the runner-up for the Young Ham of the Year award. He is very active in public-service communications, organizing as well as working on events. Here are some of the guidelines that the Georgia hams used during the event. Note the handling of medical information; this may be useful on some of your events.

1. Do not leave the main net frequency without clearance from net control. Your venue coordinator may have a "talkaround" with one station transmitting on the main net. Keep net control "in the know." Notify the net when you get on location and when you get ready to leave.

2. If you have medical, weather, or other emergency traffic, call BREAK BREAK, then your callsign. Net control will immediately acknowledge you.

3. A word on medical traffic: *Do not transmit identifying patient information via amateur radio. Period!* As you know, our signals can legally be rebroadcast, and we don't want to "accidentally" tip the media. Advise the venue director to use his or her *Georgia Games issued cellular phone!* You can radio for help; just do not provide the patient's name or other identifying info!

4. Wear your official T-shirt and credentials at all times. If questioned by security, please be polite and courteous. They are volunteers, just like us. If they deny you admittance to an area you need to be in, advise net control.

5. *Net control has complete authority over the net.* Remember, we're just communicators. The way net control got the answer to your question was to ask someone in the operations center.

6. *Document, Document, Document!* Try to keep some notes. If you have a strange, unusual, or emergency request, try to get the venue director to write down the message and sign it. This minimizes our liability and responsibility.

7. *Do not kerchunk any repeater or frequency.* Always ID with your callsign and "testing."

8. Tactical calls, using the name of your sport, are encouraged. Remember you must end your transmission with your FCC-issued callsign, though.

9. Remember that we are only communicators, not decision makers. We get the info to the right person for him or her to make a decision!

10. Net control will be using a computerized "dispatch" system. Please advise net when you arrive at your location and when you clear (leave).

cord/rope for antenna raising, brochures, rope for antennas, lead weights (1 and 2 ounce), two-wheel cart, wheelbarrow, rake, shovel, pick ax, ladder, garbage bags, flashlights.

You're now all ready to head out into the field or out to supply important emergency communications, right? Not quite! While you may have all of the radio equipment and a table on which to operate, we haven't talked about the person skills that are needed.

In order to set up the site, you need a transportation coordinator, someone to take care of the generator, people to put up antennas, others to set up the tents or operating positions, and a cook. On the operating side, you need someone who knows how to pass a message, people who know how to use the logging programs, and someone familiar with various digital technologies, including packet, APRS, and PSK31. If you know everything, then you're very talented. In most cases this is a time to learn and become familiar with a new area of communications.

The Big Day

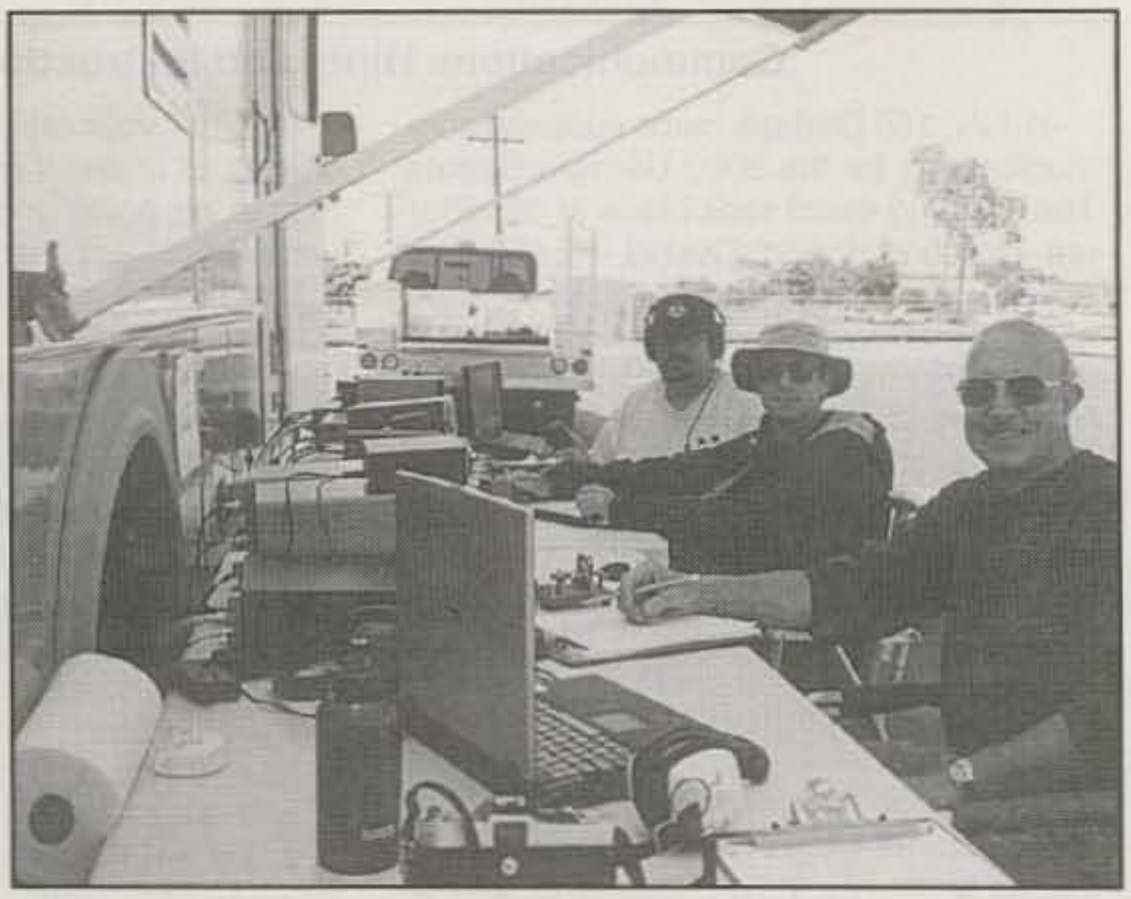
Field Day arrived this past June. It was great weather—hazy, hot, and humid. The K6R site at the Camarillo Airport in California had everything planned out. However, as is usually the case, there was a little hitch.

The plan to put up antennas was simple. Ed Rogoff, K6RSD, explained that they intended to tie a light string to a rock and throw it over an 85 foot tall lamppost."It didn't occur to us how hard it would be to actually toss that little rock and a long string that far," he said. "Next idea was a slingshot. As it turned out, this idea was a lot easier physically, but no more accurate than the rock and string. Out came the old stand-by bow and arrow for an attempt. Again it took less effort, and it brought with it less accuracy as well."

Just when they were about to give up, a friend walked over and offered to help. What could he have in mind?

Henry Ganter, president of Sun-Air Aviation, offered to pilot the company's jet helicopter and drop a line over the top of the unreachable lampost. In 10 minutes the antenna was up. Who ever would have thought the antennas would be dropped in place from above. None of the group had ever done anything like this before, but they were able to hoist three wire antennas—a 10–80 meter

VHF operator Alan Barack, N3XSO, went fishing for every contact he could make. (Photo by WA3PZO)



Past members of the Alhambra High School (California) Amateur Radio Club take a break during Field Day. Front to back: Ken Hanson, N6KS, Greg Schultz, N6IAF, and Ed Rogoff, K6RSD. (Photo courtesy K6RSD)

dipole, a windom-sloper, and a longwire V-beam—with just one line.

On VHF

In the Philadelphia area the VHF bands were rather quiet in the early morning hours. The operators on duty knew that they had to make contacts, but the best they could do was put a call out and listen. The bands simply were dead. However, just to show that hams can have fun even in a bad situation, Alan Barack, N3XSO, of the Holmesburg Amateur Radio Club, went the extra mile to attempt to make a contact. He was asked what he was doing. Better yet what was he using for bait? He said he was fishing for any contact he could make. While he never actually revealed his secret bait, many guessed he was using RF Balls—of course!

A Place for You

So now that the fun is over, we can take a moment and think about all of the different skills the group needed to operate Field Day.

Take a moment to think about being ready to be called out at a moment's notice for emergency communications. Do you know how to use some of the latest radio equipment or the latest software for PSK31? If asked, could you pass a formal message for a local official? These all are skills to learn, and many of them can be learned in your own home. Others can be part of a club program or a meeting topic.

If you are like most hams, you have that special Field Day story. And many clubs members are already planning for next year. Between now and next June learn something new about the hobby. How about offering to teach a subject in which you're an expert?

Back to Business

Field Day isn't about getting the biggest score. It's about team work. It's a story of how many different skills it takes to set up a station in the field and keep it on the air. Don't ever feel that you can't contribute something to amateur radio public service.

Next month we'll cover more amateur radio public-service activities. Do you have a story to tell? Your information helps shape this column. Let's hear how you are serving in the public interest. Until next time!

73, Bob, WA3PZO

QRP

BY DAVE INGRAM, K4TWJ

The Art of Low-Power Hamming

Homebrewing Today and Tomorrow

Ever since the early days of radio, homebrewing miniature rigs, experimenting with new circuit ideas, and building kits has been an integral part of the QRP experience. Indeed, this "need to dink" drives many low-power enthusiasts to spend more time in their workshops than on the air. Why such an unquenchable desire for assembling part or all of one's radio equipment? Some QRPers say it is the thrill and exhilaration of spanning long distances with only a pocket-size rig, some point out the economical cost of kit gear, and some just enjoy saying, "I built it myself—and it works!" Personally, I say all of these reasons have merit. Building your own gear is indeed a special form of personal expression—in assembly, in packaging, and in use, plus it is tangible evidence of one's technical expertise.

Bearing in mind the above facts, let's kick off this month's column with a brief look at homebrewing and kit building today and consider how changes in technology will affect it tomorrow.

The changes we are noticing (and the changes that are starting to appear in present-day kits) utilize more tiny surface-mount components. Eventually, they surely will overshadow or replace regular "leaded" components with wire leads, such as resistors, capacitors, transistors, etc. Why? It is simply a matter of supply, demand, and economics. Leaded components are starting to become a bit scarce and are rising in cost, while surface- mount devices (SMDs) are becoming more plentiful and dropping in cost.

Surface-mount construction is usually pursued commercially using an expensive robotic-type machine, but building SMD equipment by hand at home is easier than it sounds. In fact, it is quite similar to the Manhattan-style construction described in the August QRP column, except it is smaller and SMD pads "stay put" rather than breaking loose from the main board when stressed. Anyone can build tiny surface-mount projects. The secrets for success are just using a headband-type magnifier, utilizing a small-diameter iron and solder, and exercising patience. Really. Try building one of the new SMT kits from Embedded Research or NorCal (The Northern California QRP Club) and see for yourself (photo 1)! A neat "helping hand" device for SMT work, incidentally was also described in July *QST*. Check it out.

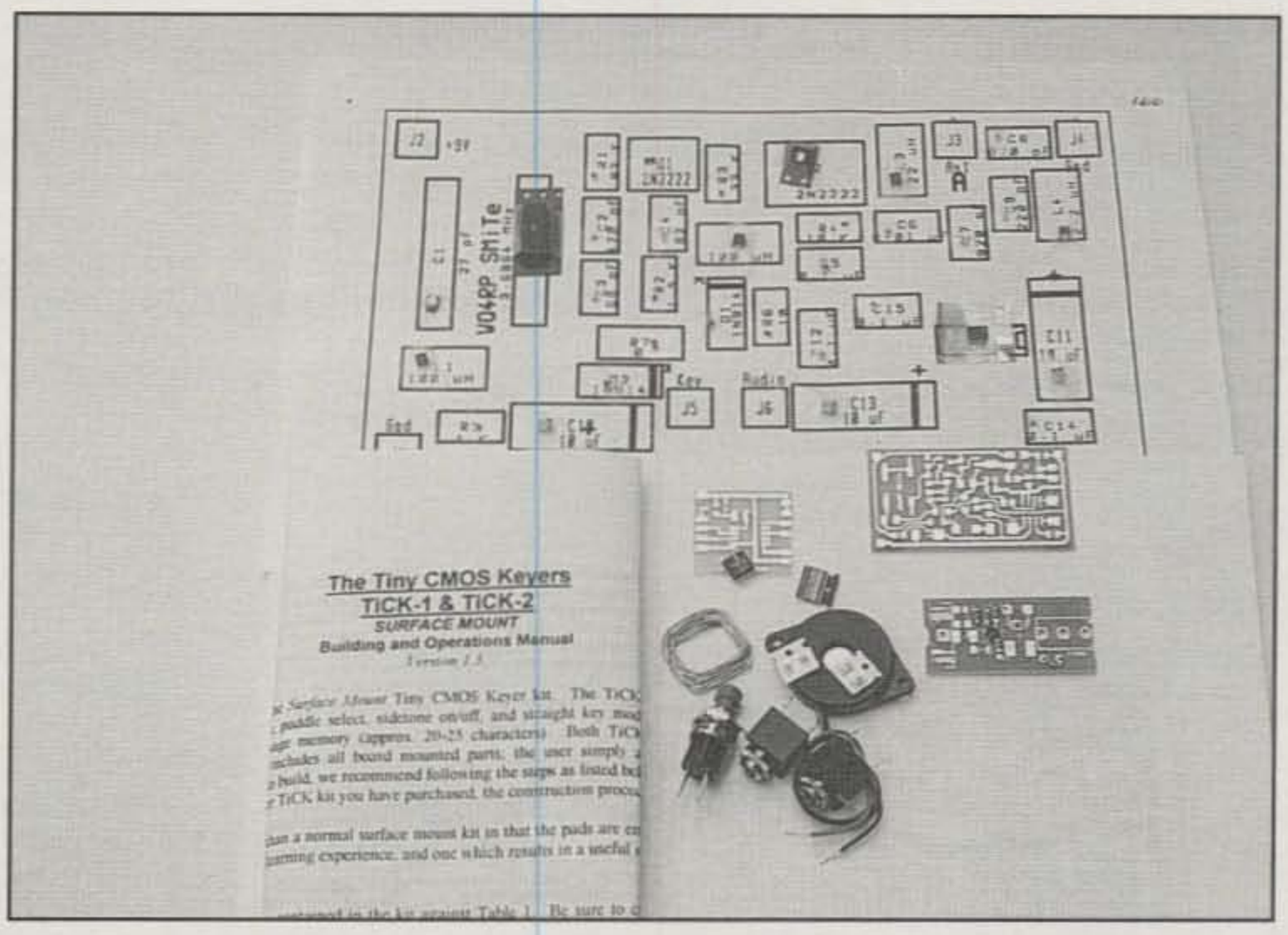


Photo 1– You say you enjoy new pursuits and experiences? Try your hand at building surface-mount projects and kits. They are surprisingly easy to assemble, especially when their components are laid out on a tape-backed positioning guide. Using tweezers, you just lift one chip component at a time and install it on the PC board. Surface-mount kits shown here include the KnightSMite transceiver (which sold out right after taking this photo!), Embedded Research deluxe keyer, and my mini-Micronaut transmitter. A new surface mount transceiver kit should also be available from NorCal by the time this column appears in print.

We will discuss surface-mount assembly more in future columns. Meanwhile, let's take a quick tour of the present-day QRP market—that is, after reminding newer amateurs that QRP is much more than a technically oriented pursuit for homebrewers. Indeed, some of the best operators in amateur radio are QRPers who simply do not have the spare time to build gear, and we can always use more good operators in QRP. Personally, I think that is the *real* fun side of QRP. Working DX with a little low-power rig is fantastic! Oops—I am about to slip into what has been dubbed my "sideshow barker" mode, so let's look at what's hot in kits today.

Kits 2K

You say you have heard of only a couple of companies producing kit gear and accessories for QRP and assumed the selection of goodies was limited? Well, friend, check out Table I. Over a dozen suppliers of cool kits are listed, and that list does not include all the individuals and QRP clubs that also produce kits. My list may be incomplete, as there are always companies accidentally overlooked that should have been included. If I missed your company, I apologize and invite you to send me information and photos of your items for inclusion in a future column. Act quickly, and I may be able to squeeze it into the December "Christmas Gifts" special column. Fair enough?

4941 Scenic View Drive, Birmingham, AL 35210
e-mail: <k4twj@cq-amateur-radio.com>

Commercial Manufacturers/Producers of QRP Kits and Projects

Company	Product(s)	Telephone Order Line	Website
Ten-Tec, Inc. 1185 Dolly Parton Pkwy.	1300 Series monoband CW transceivers	1-800-833-7373	www.tentec.com
MFJ Enterprises, Inc. P.O. Box 494 Mississippi State, MS 39762	Cub monoband CW transceivers plus 9000 series of preassembled CW and SSB monoband transceivers	1-800-647-1800	www.mfjenterprises.com
Elecraft P.O. Box 69 Aptos, CA 95001	K2 multiband CW & (optional) SSB transceiver	831-662-3845	www.elecraft.com
Wilderness Radio P.O. Box 734 Los Altos, CA 94023	NorCal NC40, Sierra & SST monoband CW transceivers	415-494-3806	www.fix.net/jparker/wild.html/
Vectronics 300 Industrial Park Rd. Starkville, MS 39759	Transmitter, receiver, & transceiver plus CW & SSB filters, & more	1-800-363-2922 or 1-800-647-1800	www.vectronics.com
Small Wonder Labs 80 E. Robbins Ave. Newington, CT 06111	Green Mountain & DSW transceivers, digital dials, & more	—	www.smallwonderlabs.com
Kanga USA c/o N8ET 3521 Spring Lake Dr. Findlay, OH 45840	Wide variety of transmitters, receivers, & transceivers, plus accessories	419-423-4604	www.bright.net/~kanga/kanga
Oak Hill Research & Morse Express 2460 S. Moline Way Aurora, CO 80014	OHR100 & 500 transceivers, WM2 wattmeter, keys, & more	1-800-238-8205 or 303-752-3382	www.morseX.com
Red Hot Radio c/o Dave Fifield, AD6A 1717 Andover Lane San Jose, CA 95124	NorCal NC20 CW transceiver	408-390-6805	www.redhotradio.com
Embedded Research P.O. Box 92492 Rochester, NY 14692	Tick Keyers, Pixie Mini-Xcvr	—	www.frontiernet.net/~embres
EMTECH 3641-A Preble St. Bremerton, WA 98312	NW Series monoband CW transceivers, ZM1 antenna tuner, & more	360-415-0804	roygregson@aol.com
A&A, S&S, Ramsey (see text)			

Table I– Popular commercial manufacturers/producers of QRP-related kits and projects for homebrewers as of mid-2000. Web addresses and telephone numbers are always subject to change. (Discussion in text.)

Now referring to Table I, we begin with two of the oldest and most familiar names in QRP: Ten-Tec and MFJ. Both companies have avidly supported QRP for several decades.

Ten-Tec is best known for its famous Argonauts of eras past (the first full-featured QRP transceiver) and their presently popular 1300 series of monoband kit transceivers. The 1300s (which were reviewed last year in my May "World of Ideas" column) are proven good performers at a reasonable cost (under $100).

MFJ's new "Cub" transceiver kit is another blowout hot performer in the under-$100 category. It also sports a clever, progressive design in kits: Over half of its components are machine-preinstalled surface-mount devices. You just install its regular size and band-related components to complete the kit. This gem was also highlighted here in the June QRP column. No time for kit building? MFJ also sells a 9000 series of pre-assembled SSB or CW transceivers (and even hefty wall-wart power supplies for them) that are very popular among QRPers.

Elecraft is a new, up-and-coming company with a hot item that is taking the QRP world by storm—the fancy-featured, multiband K2 kit transceiver. The K2 is also filling a "top of the line" gap left open when Index Labs stopped producing their well-known "QRP Plus" transceiver. What is the cost of going first class in QRP? A basic K2 is in the $600 category, with options such as SSB and 160 meter operations increasing the cost. Nice!

Wilderness Radio has not been advertising much lately, but their deck-of-cards-size SST transceiver continues to enjoy high popularity and work out like crazy from shacks nationwide. The SST is another "under $100" treat. Other familiar Wilderness kits include the Sierra and NorCal 40 transceivers.

Small Wonders Labs is well-known for its "DSW" and Green Mountain transceiver kits. Owner Dave Benson, NN1G, also recently has added a 20 meter SSB transceiver kit, a PSK31 transceiver kit, a voice-announcing frequency readout kit, and more to the line.

Vectronics offers a wide variety of easy-to-brew kits, including a direct-conversion receiver, a Tub-transistor transmitter, narrow CW filter, SSB audio filter, and more. Most Vectronics kits are in the "under $30" category and are good first projects for new homebrewers.

Kanga is a big-name producer of QRP kits in England, and their U.S. liaison/distributor is Bill Kelsey, N8ET. The Kanga line ranges from a tiny one inch

Photo 2– How do you spot a big-time QRP station? By its lack of large transceivers, naturally! Here, for example, Bill Penhallegon, W4STX, shows us his prescription for QRP happiness with a white-faced Oak Hills Research transceiver, MFJ antenna tuner, small AC power supply, and (between the Oak Hill Research transceiver and desk lamp) a new red-case, Red Hot Radio, 20 meter mini-transceiver. As discussed in the text, Bill's setup gives a good account of itself on the air.

square transmitter (the Oner) to several types of receivers and transceivers, including a multiband, microprocessor-controlled item.

Oak Hill Research, a well-known company, was purchased by Marshall Emm, N1FN, of Morse Express fame a couple of years ago. Its product line includes the familiar "100" monoband and "500" five-band transceiver kits, WM2 QRP wattmeter kit, and DD1 digital dial kit. All are supplied complete with custom cabinets.

Red Hot Radio is a new company started by AD6A. It presently is producing the NC20 transceiver kit, which is a commercial version of the North California QRP Club's NC20 project. More details later—hopefully.

EmTech is a time-proven company

Photo 3– Have QRP, will travel! This go-anywhere mini-rig cabinet was made by Dick Swanson, KØRDS, and it turns any tabletop or campsite into an instant ready-to-operate QRP station. The cabinet is a scant 9 inches high by 17 inches wide and has a swing-down front cover plus slip on/off base support section.

with an "NW series" of monoband transceiver kits sporting a good-quality reputation. EmTech also offers a ZM2 antenna tuner plus visual SWR monitor.

Embedded Research is famous for its one-pushbutton-controlled single- IC keyer kits. They have been featured in past columns and are available in leaded and SMT version.

S&S, A&A, and Ramsey Electronics were familiar names in QRP kits several years ago, but we have not seen their ads or heard from them lately. Maybe this mention will prove to be a friendly prod.

Looking again at Table I, I feel confident in saying there is a kit for every interest and tech level in QRP. They are all nice and priced so you can buy several of them. Enjoy, and remember to allow plenty of time to use your new toys after assembly. That's the big thrill!

Photo 4– The KØRDS mini-rig cabinet with PVC base stand attached for QRP'n and camp'n. The fully self-contained station consists of an SGC-2020 transceiver, MFJ antenna tuner, and 7 amp/hour gel-cell battery.

More Show and Tell

We continue to tell you about all the thrills, excitement, fun projects, and unique opportunities for personal expression in QRP. Let's highlight some more real-life examples of that fact.

A few months ago, Bill Penhallegon, W4STX, in Clearwater, Florida answered one of my QRP CQs on 30 meters. His signal was not exceptionally weak or strong, and I assumed that like many 30 meter operators, he probably was running 50 or 60 watts to a G5RV antenna (G5RV recently became a silent key, incidentally. He was a classic, and will be sorely missed). A quick inquiry revealed an eye-opening answer. Bill was running only 4 watts with a little white-faced Oak Hill Research transceiver and a dipole antenna (photo 2). We chatted a few minutes just as if we both were running "big rigs," and signed off. A couple of listeners on frequency then began calling Bill. If that does not prove a little QRP goes a long way, nothing does!

Bill says he has also operated QRP from several Caribbean islands and has

Photo 5– This "magic jumper" was devised by Lee Collison, KL7GRT, and it definitely gets our vote for QRP fun project of the year. The dummy jumper is actually a Micronaut Transmitter in disguise. You apply keyed DC voltage to one PL-259, connect the other PL-259 to an antenna, and it transmits a 100 to 250 mw signal. Look ma, no rig!

a big stack of QSLs from around the world to further prove QRP romps. When asked about some memorable home QTH QSOs, Bill recalled our 30 meter QSO and a contact with N3AO in Pennsylvania. In the latter case, both operators were using brand-new Red Hot Radio NC20 transceivers, and again the QSO happened without pre-planning. QRP is indeed alive and thriving on today's bands!

Dick Swanson, KØRDS, needed a convenient, secure way to carry his QRP gear and facilitate quick setup when camping, so he devised the handy flip-open mini-desk shown in photos 3 and 4. The combination cabinet and portable desk measures 9"H × 17"W × 8"D, and its hinged front cover swings down to produce a flat writing surface while operating. An SGC2020 transceiver, MFJ-971 antenna tuner, and 7 amp/hour gel-cell battery, wired and ready for operation, nestle in the desk's lower section, while a Delta Loop for 20 meters, logbook, mic, and key store in the upper section. The cabinet is made of 1/4 inch plywood, and its slip-together base/leg section is 3/4 inch PVC. Clever idea, eh?

Finally, Lee Collison, KL7GRT, shares a view of his handiwork in QRP ingenuity in photo 5. First Lee built one of my little Micronaut QRPp transmitter kits (which, incidentally, have become rather famous since setting a QRP DX record on 17 meters). Then Lee mounted the Micronaut in a most unusual enclosure—a short piece of dummy RG8 coax cable with PL259s on each end. The cable's "innards" have been replaced with the Micronaut; its keyed DC/battery connections wired to one PL259; and its RF output connections wired to the other PL259. By connecting this "coax jumper" to an antenna's transmission line and applying 9 volts from a battery with a key in its negative lead to the "input PL259," it transmits a QRPp signal on 80, 40, or 30 meters. Lee says he demonstrates this little treat at club meetings, and it always captures attention. Now that's what we call having fun with QRP! Jolly good show, Lee!

That brings us right up to the closing wire for another month. I will thus close with an upbeat reminder that sunspots are presently peaking and the HF bands are blowing wide open with great conditions for DXing. If you plan to ever get on the air and enjoy QRP'n, now is the time! Do it, and remember to listen for me too. I will be the weak one running QRP. May the force of good signals be with you! 73, Dave, K4TWJ

Amateur Television

BY ED MANUEL, N5EM

All About Ham TV

Planning for ATV at Special Events—Part II
A Portable ATV Repeater

An ATV repeater is really a very simple thing. We think of repeaters as complex and technically difficult to build and operate, but that is largely a result of our experiences trying to make in-band repeaters work. The challenges of trying to receive and transmit in the same band at the same time, and sometimes on the same antenna, certainly can cause one to lose both religion and hair. Fortunately, we are not trying to do that with this project. We are going to create a cross-band repeater that transmits and receives in different bands.

This does not eliminate all of our problems. We still have to think about the frequencies in use and the technical details as we assemble the system. First, consider the frequencies. We certainly don't want to set up a machine that has harmonically related inputs and outputs. Our transmitter has second and third harmonic energy that is difficult to suppress completely. For example, a 421.25 MHz transmitter has second harmonic energy at 842.5 MHz and third harmonic energy at 1263.75 MHz. We would not, for example, want to make a system that transmits on 421.25 and receives on 1265—both common ATV frequencies. Likewise, we might expect to have problems transmitting on 1255 and receiving on 2.4 GHz. While the second harmonic is not precisely on the receive frequency, it can be a cause of front-end overload. Consider your inputs and outputs and be prepared.

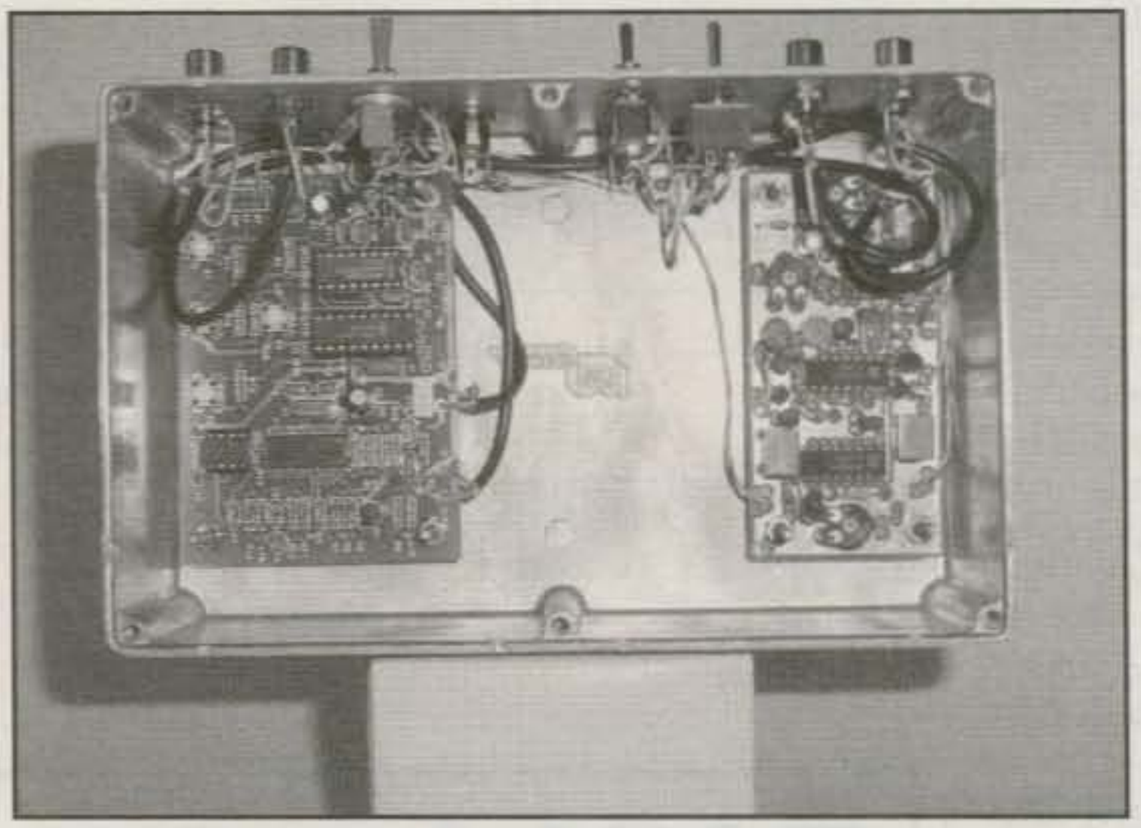


Fig. 1– The repeater controller, top view.

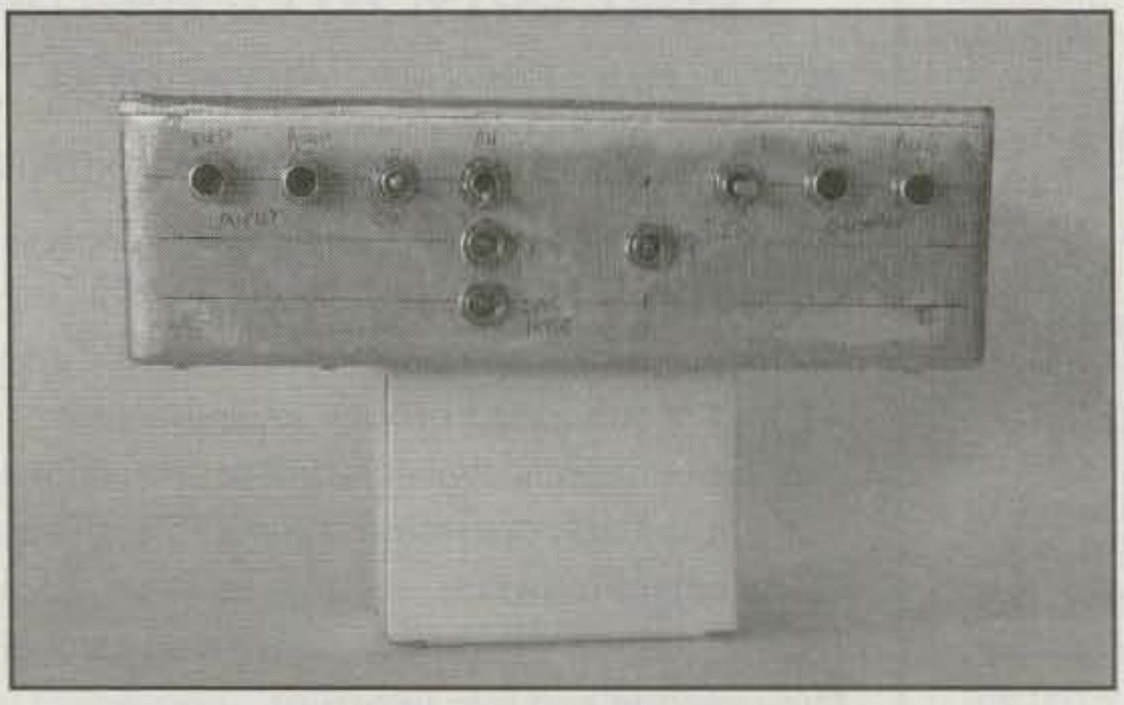


Fig. 2– Front view of the repeater controller.

I am using an input frequency of 915 MHz and an output frequency of 1255 MHz. The 915 MHz transmitter is attached to the portable camera for wireless connectivity. The 1255 MHz transmitter is the link into the main ATV repeater. This will provide our wireless local coverage back to the repeater.

There are several ways you can make the connection from received video to transmitted video in a simple repeater. There are microprocessor-driven ATV repeater controllers available that have multiple inputs and many features available by touch-tone control. These are fine for a regional repeater, but I needed something that fit the KISS principle (Keep It Simple, Stupid). I selected the PC Electronics VOR-2A. This is a circuit that has long been a mainstay of ATV repeaters. Simple and tested, it provides the necessary circuitry to detect the presence of a video signal and close a relay that can be used to key power to a companion transmitter. In addition to detecting the presence of video and keying the transmitter, the system needs to identify itself to be legal. The VOR-2A has timers to do this from an external identifier. This device can be as simple as a camera and card with the ID drawn on it or as complicated as a microprocessor identifier. The logic of the VOR-2A is designed to have the video output fed from an on-board relay that selects between the input video source and an off-board source of video that carries the identification.

For a very long time, ATV repeater builders cut their teeth on the VOR-2/A and the Elktronics ID generator board. We still have those items serving the HATS system in Houston, even though a few years back we purchased a microprocessor repeater controller with more functions.

In the case of my portable repeater controller, I opted for a different approach to identification. One problem with ID screens when doing public-service work is that they tend to become obtrusive. It seems as if something is always bringing up that identifier just when you are viewing something interesting. Consider a wireless camera link. There is the camera and link transmitter. That system needs to be identified. There is the portable repeater system, which also needs to be identified. Then there is the main repeater which also needs to ID. If only we could get them to do it once every 10 minutes for 5 to 10 seconds at

4734 Shetland Lane, Houston, TX 77027
e-mail: <n5em@cq-amateur-radio.com>

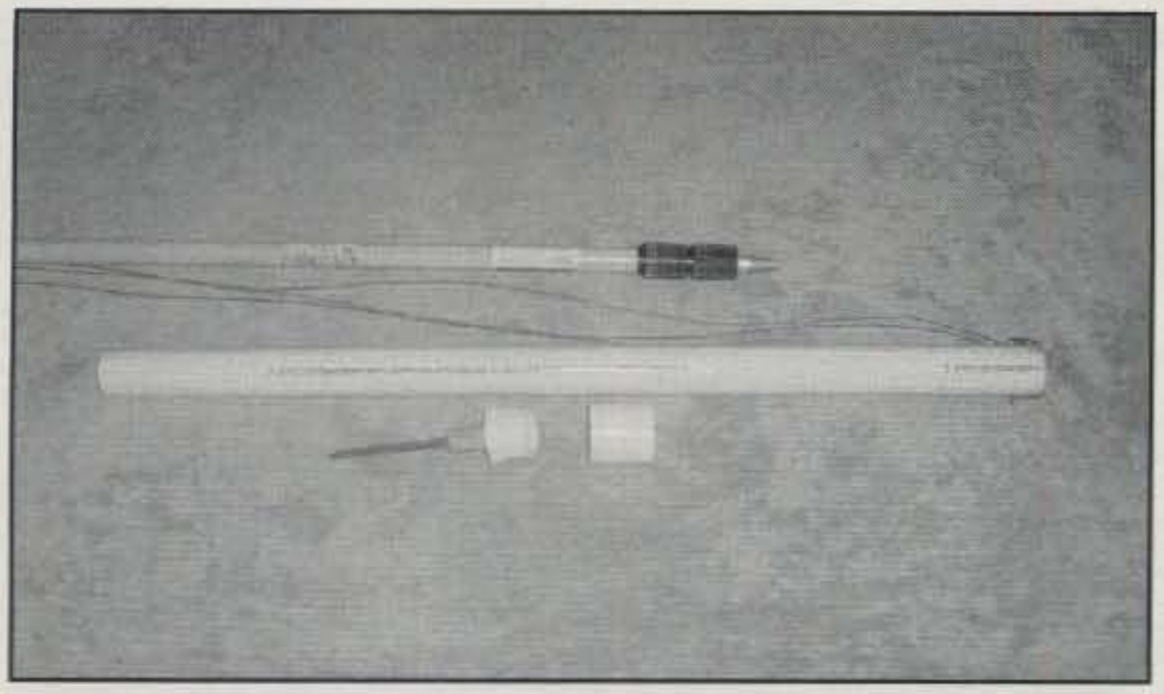


Fig. 3– The mast kit.

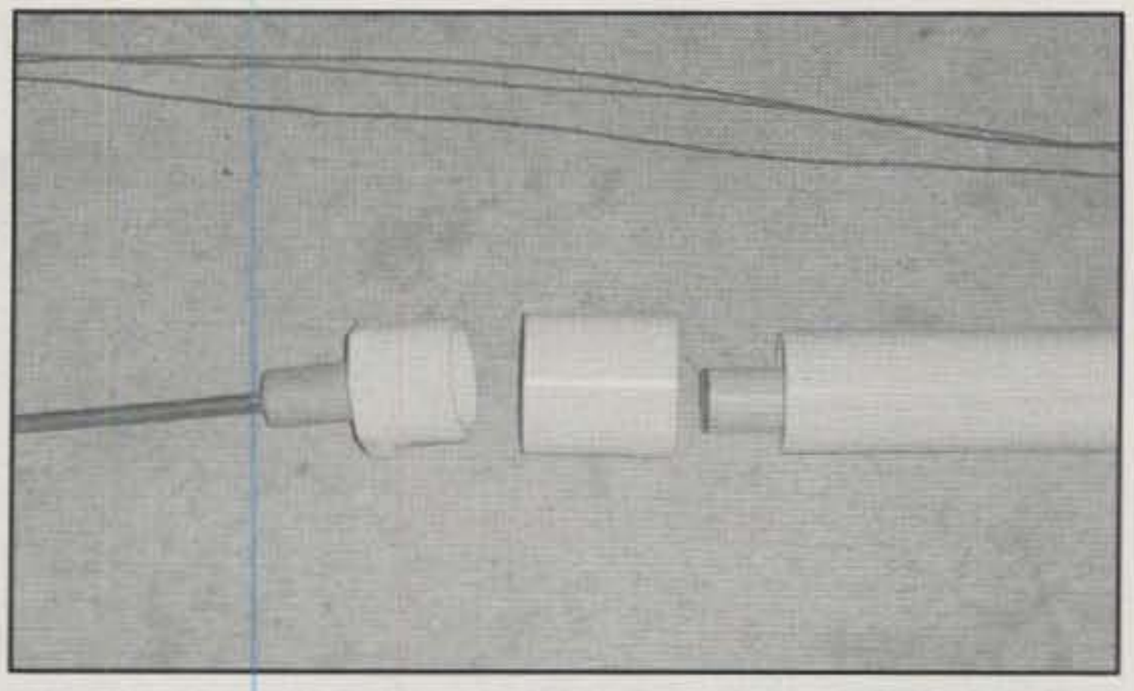


Fig. 4– Mast assembly.

precisely the same time, things would be great. Typically, however, we find that every 2 or 3 minutes one of the transmitters decides it's time to bring up that ID screen and take over the show.

I chose one of the new identifier circuits from Intuitive Circuits. The OSD-ID (PC) (On-Screen-Display, PC programmed) has the ability to overlay the identification on the live video. Further, it has the ability to do it in a transparent mode. Have you noticed those really cool network identifiers on your cable system? They overlay their logo in the lower corner of the screen, and you really don't even notice it since the video passes right through it. This allows the local identification to be as unobtrusive as possible during the event, leaving the interruption of the main repeater a minor annoyance.

I ordered both a VOR-2A and OSD-ID (PC) from PC Electronics. They are very small boards, able to be put into a very small package. Since I planned to package the control circuitry with a small dual-band FM ATV receiver, I chose a die-cast aluminum box of the same size. The one locally available was a bit thicker than necessary, but you never know what you'll want to put in there later, right?

An important consideration when building a television repeater (or any television system, for that matter) is to keep radio frequency (RF) energy from interfering with the video signals. This is done by using high-quality shielded cables for video and audio and properly bypassing the power and control leads for RF. This means using feed-through capacitors, or using shielded connectors for power and bypassing the leads for RF at the connectors. PC Electronics recommends using feed-through capacitors. I wanted more flexibility in connecting and disconnecting my system, so I opted for coaxial power connectors. If I experience RF problems, I'll have to change these out. So far, so good.

It also helps to keep the power output of transmitters at the lowest level consistent with doing the job. In other words, if a 100 milliwatt transmitter will do the job and make the link, don't use a 5 watt transmitter. This assumes that you have more than one transmitter from which to choose. You can also use a low-power transmitter and an external power amplifier for a choice of power levels for different situations.

For the camera-mounted link transmitter, I chose a small mini-box. This transmitter is also a reasonably low-power unit that does not interfere with the Sony camcorder I use. Unfortunately, it does interfere with the physical operation of the camcorder. There are controls and functions on every conceivable surface of the Sony. It is truly a marvel of engineering.

To support the link transmitter I had to fabricate a bracket which did not block access to any of the operating controls. I wanted the link transmitter above the area of the camcorder during normal operation. That puts the antenna up above the heads of people in the vicinity of the operator. I did not want the people walking around my position to cause the signal into the link system to vary (*It's also prudent, in view of RF safety considerations, to keep the main field over people's heads.—ed.*). Also, as we all know, antennas just work better if you get them up in the air. The use of a bracket for elevating the link transmitter rather than elevating just the antenna alleviates the requirement for a piece of lossy feedline. All that is needed is a very short video/audio jumper and power lead. A simple switch controls transmit manually when the operator is ready to go live.

There are five items in the repeater system. First is the control unit I described previously (VOR-2A and OSD-ID PC. Second is the dual-band FM ATV receiver. Third is the 1.2 GHz transmitter. Fourth is the battery supply that provides operating voltage to the system. Finally, there are the antennas, mast, and feedlines.

I discussed the ATV receiver in the July column. It is available from PC Electronics (Model 33/23FMR) and is just what I needed in a portable system. The availability of this small, DC-powered, sensitive, dual-band receiver really made this project practical. We have built portable repeater systems before. The one I remember in particular was housed in a 4 foot high rack cabinet and required 110 VAC. It took two people to move it and even more to lift it into the pickup or van required to transport it. Other groups have made smaller systems, I am sure! I wanted my system to occupy little more than a briefcase, with the antenna system being the largest single component.

I still had one of the original COPS 1.2 GHz transmitters. These have been described previously and are no longer available. A suitable replacement is available from PC Electronics and is the cousin of the 33 cm transmitter I am using for my camcorder link transmitter. Since it was already packaged and ready to go, I chose to use it as is.

Antenna selection is a function of several factors. First, I wanted a non-directional antenna for the camera link transmitter. A simple quarter-wave vertical serves nicely. Second, I wanted some gain back to the main repeater site. For that I selected a small Yagi designed by Kent Britain, WA5VJB, and described in *CQ VHF* magazine (February 1999). Both of these antennas can be constructed out of inexpensive and easily obtainable materials. They can also be made very lightweight to avoid over-

loading the mast. I'll detail antennas and feedlines in the next part of this project in the January 2001 column.

There is not much point in making a small, portable ATV repeater if the antenna system takes several people to install it and a pickup truck to transport it. In my last column I discussed several available lightweight antenna mast ideas. The telescoping painter's pole has been used as a mast by many hams. You generally can find these at home-improvement stores. In my area two lengths are available—a three-section pole that extends from 6 feet to around 16 feet, and a longer pole that extends from 8 feet to around 22 feet. These poles are reasonably sturdy when extended. A simple base can be fabricated in a number of different ways. One I like is to use 2 inch PVC pipe, a 2 inch to 1 inch pipe adapter, a 2 inch PVC pipe coupler, a length of 1.25 inch wooden dowel, and a large steel spike.

The PVC pipe adapter has a section of wooden dowel inserted into its small end. The steel spike looks like a huge nail. Using a hacksaw, cut off the top (flat part) of the spike. Drill a hole in the wooden dowel for the steel spike. Make sure that the hole is just large enough for the spike to be forced into it. Cut the PVC pipe to obtain a piece about 40 inches long. Drill three holes in the top of the pipe at 120 degree intervals around the end about one-half inch from the top.

In use, the mast is extended and then antennas and feedlines are attached. The PVC base is assembled and slid over the bottom of the mast. The assembly is then walked up until vertical and pressed into the ground. The spike makes penetration of the ground easy. The entire assembly will stand up straight until you can take the three guys (I use 3/32 inch Dacron or Kevlar reinforced cord) and stake out the base using heavy tent stakes. You will note that the pole is smaller than the inside diameter of the PVC pipe. I use this base for other masts, and some are larger than the painter's pole. The mast is made stable in the base by stuffing a piece of pipe insulation into the open space at the top of the pole. That keeps the pole from wobbling in the base.

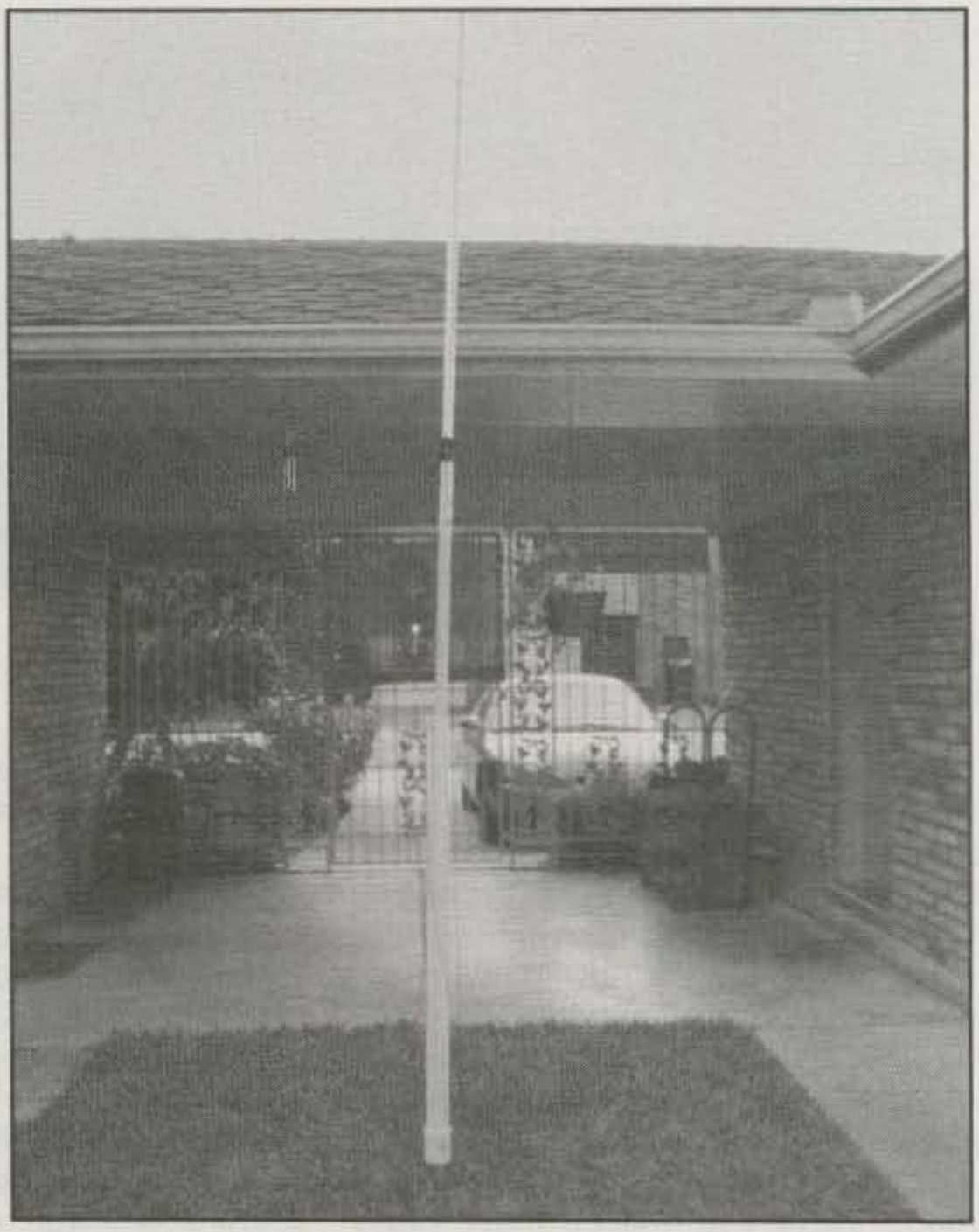


Fig. 5– The standing mast.

This provides a base that can be guyed in a small space and gives a good footing for the mast while keeping it straight. A single set of guys (Dacron cord) at the top of the second section keeps the pole straight up after erection. An easier method is to lash the pole to any reasonable support that is handy. However, sometimes nothing is handy, and the more complex approach must be used.

Remember to practice safety. If you have a good wind, get help. This simple spike base won't hold if the breeze is too strong. Also, I use lightweight antennas. Don't try this with big, heavy ones.

One problem that persists in making my system as small and lightweight as I want is the weight of feedlines. The sad thing is that small, light feedlines are lossy. Low-loss feedlines are bulky, stiff, and heavy—not what you want if your pole is light to start with. I selected RG-8X for my antennas. For my application and intended location, that works fine. If you are working with a more marginal path, you may require more transmit power when line losses are factored in. I'm working on some more exotic approaches, but they are not ready for prime time just yet.

In the next edition of this column I'll present the rest of the details along with more photos of my system. That's all the space this month, but if you want to follow this project, you can find more photos on my web page at <http://www.hqrp.stevens.com/atvrepeater.htm>. The real field test will occur in January, when I take the system out to the Houston Marathon.

Beginner's Corner

BY PETER O'DELL, WB2D

For the Newcomer to Ham Radio

Hanging Wallpaper

The best wallpaper pattern for the modern ham shack is—awards! Big ones. Small ones. Easy-to-get ones. And difficult ones. Which one(s) do you want to go after first?

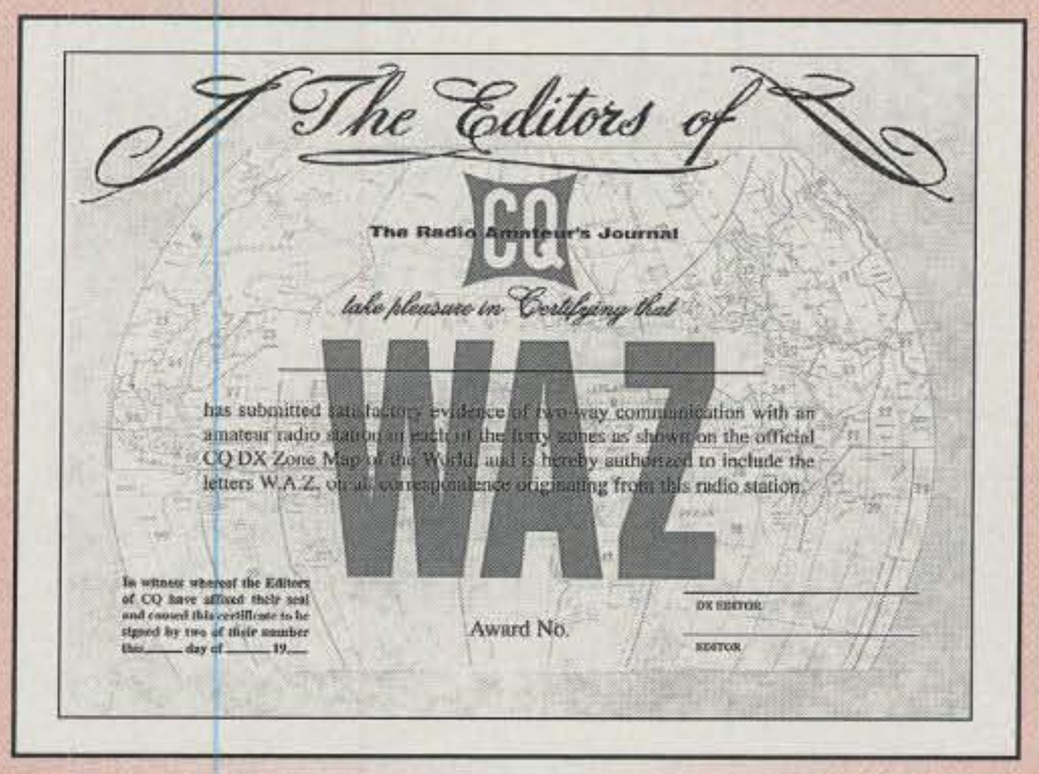
Now that you have your QSLs in hand, or at least ordered (see last month's column), it's time to figure out what you are going to do with them. You could just send them out willy-nilly, or you could make an effort to collect the ones that you need to qualify for an award. How many awards are there? That's sort of like asking how many retired people live in Florida. Someone may have counted the awards available yesterday and had a finite fix on the number, but chances are someone else set up a new one today. There are a few that stand out, though. We'll take a look at some of the more popular and prestigious awards this month.

In the days of the Novice license, the first award that most people went for was WAS. No, my word processor did not hiccup. WAS stands for Worked All States. Now that phone band privileges are available at entry level, I suspect there will be more initial interest in some of the DX awards. Nonetheless, the WAS award is a good place to start for the purposes of this column.

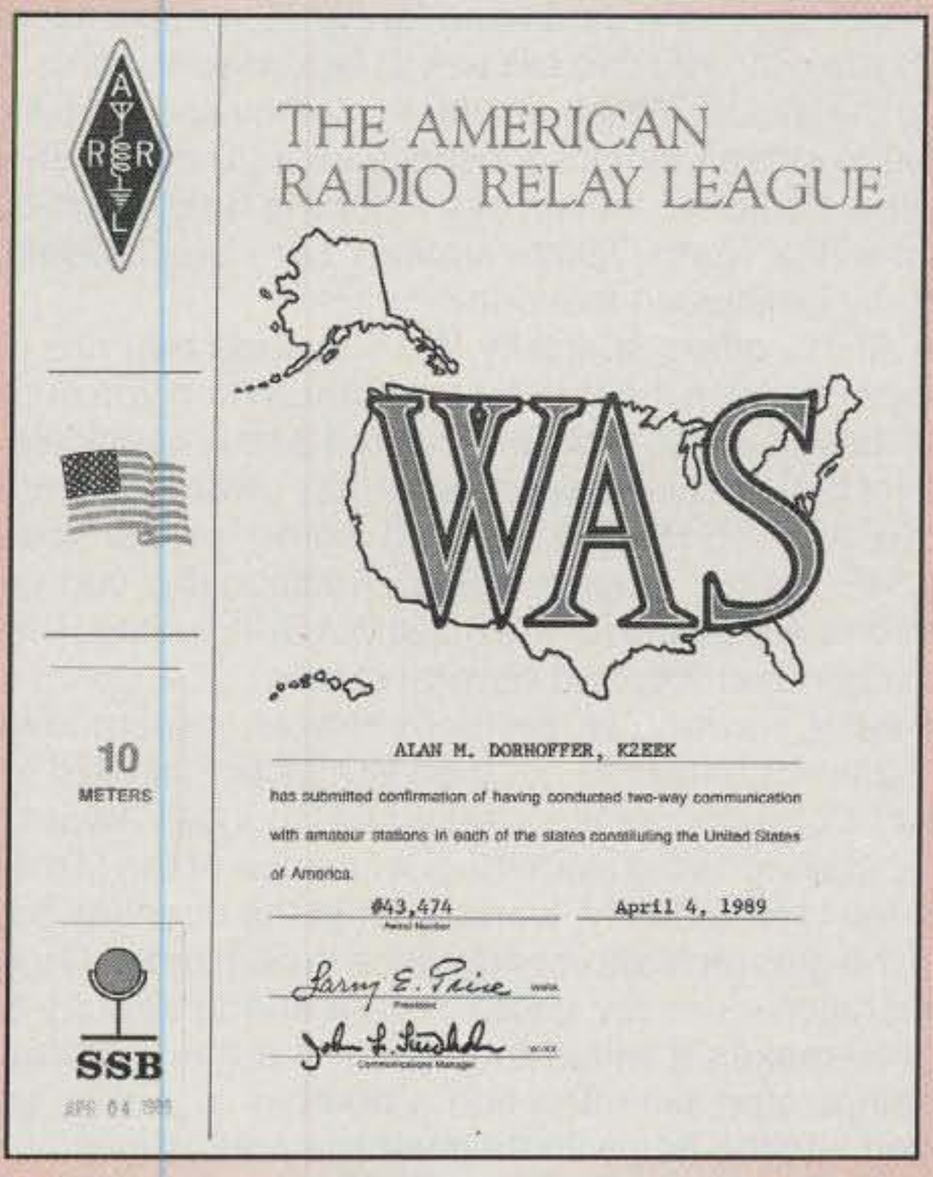
You qualify for WAS by working (and receiving QSLs from) someone in each of the 50 U.S. states. That sounds simple enough, but just getting the basic award can take a few months, as Montana, West Virginia, and other "lightly" populated states can be tricky to work. You can get a jump start on the process by working some of the contests; for stateside contacts that pretty much limits you to Field Day, Sweepstakes, and perhaps *CQ*'s WPX Contest. We'll have more about contests in a future column. Once you have the contacts in the log, you still need to get the QSL.

Here you have to think of it from the other person's point of view. If you live in New York and you are working a station in Florida, chances are you can get a QSL from the Florida station simply by mailing that person one of your cards as a postcard. There aren't that many people begging for a Florida QSL, believe me. If he doesn't respond to you, just look for another Florida station... "next." However, suppose the station you are working is in Wyoming. Every time he turns on the radio, someone is going to beg him for his card. What are the chances that he already has a New York card—maybe a whole shoebox of them. Therefore, you probably want to send him your card in an envelope with a self-addressed, stamped envelope (SASE) enclosed also. This cuts down his expense to that of simply having the cards printed, and it cuts down the effort required on his part. Why do you think companies trying to sell you something send you a self-addressed, postage-paid envelope? Simple. It works.

When you decide to go for an award, it is a good idea to contact the sponsor and ask for the rules and any forms required for submission. For instance, the WAS rules require that U.S. or Canadian hams be members of the ARRL (at the time of application) to qualify for it. Hey, it's just good marketing. By the same token, *CQ* has small filing fees that are a little lower for subscribers. There are also rules about where you were when you made the contacts. You should make yourself aware of these qualifying conditions ahead of time. Many awards have an application that will ask you to list the contacts. You may be able to fill this out as each card comes in.

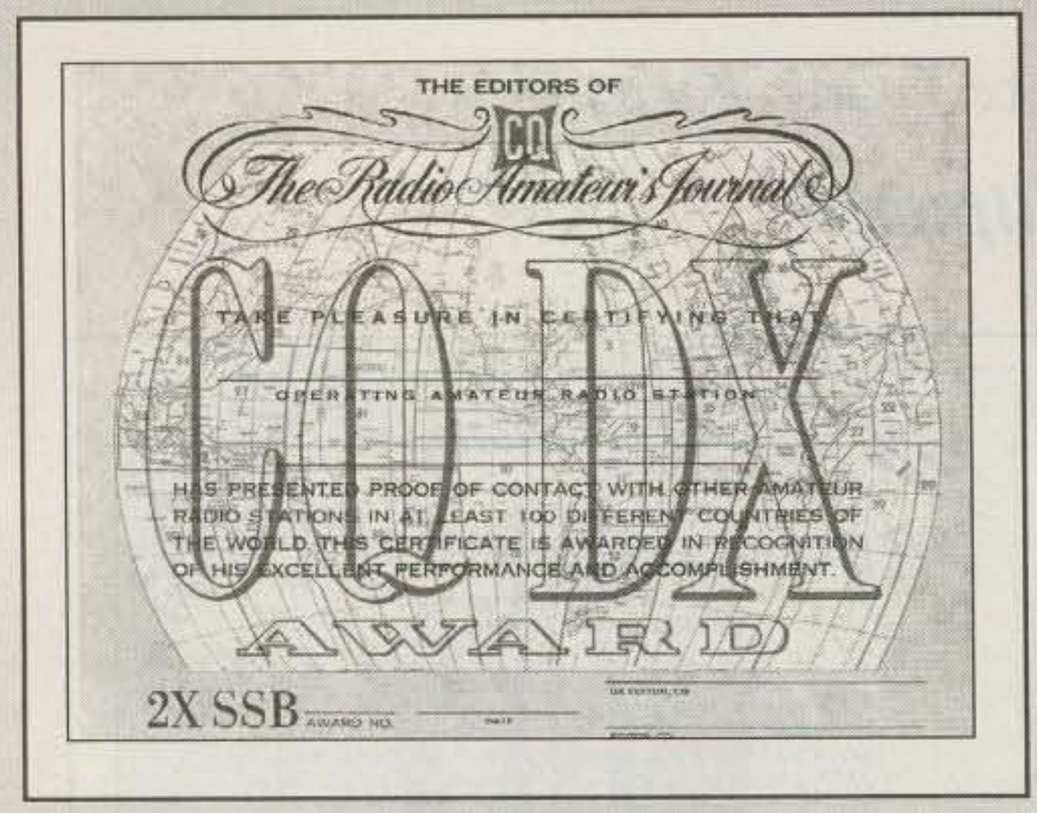


CQ's Worked All Zones award in its various forms is issued to radio amateurs presenting proof of contact with all 40 CQ zones. The 5 Band WAZ award is issued for contacting all 40 zones on the 80, 40, 20, 15, 10 meter bands for a total of 200 contacts.

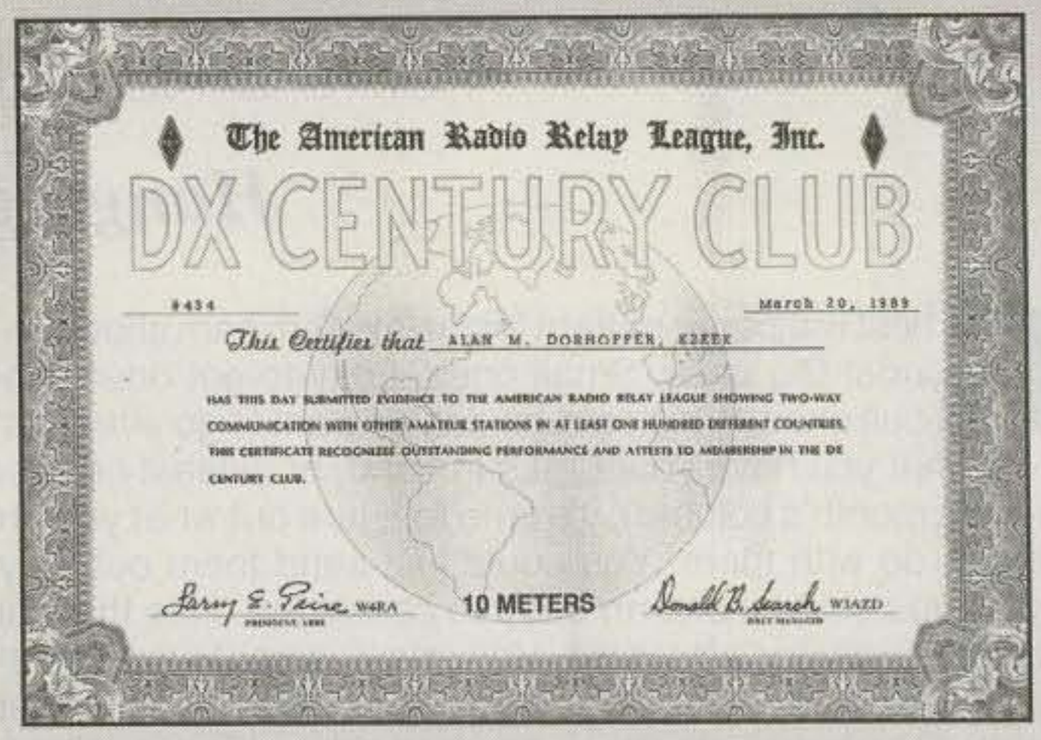


You can qualify for the ARRL's Worked All States award by working someone in each of the 50 United States.

*123 NW 13th Street, Suite 313, Boca Raton, FL 33432
e-mail: <wb2d@cq-amateur-radio.com>



The CQ DX award requires proof of contact with 100 or more countries on SSB, CW, or RTTY.



The ARRL's DXCC award, issued for contacting 100 or more countries, is available for Mixed, Phone, CW, individual bands, and satellite contacts. DXCC also has a five-band version.

Once you have all 50 cards in hand for WAS, you need to submit the cards and your application for checking. In the old days you had to send your cards to ARRL HQ and wait for the staff to check them. Sometimes that took months. Things are a little easier for all concerned now that the ARRL has instituted field checking, a part of its Special Service Clubs program. An awards manager for the club, on record with the ARRL, can check the cards and forward the application on to HQ. By the way, HQ can still ask to see specific cards before issuing the award. Which do you think they are more likely to ask you to submit for close inspection: a 20 meter SSB contact with a California station or a 222 MHz SSB moon-bounce contact with a North Dakota station? Let's see... Could I use one of my lifelines on that one?

The ARRL offers specialty WAS awards that are distinct and separate from the regular program. When you qualify for one of these awards, you are granted a new certificate numbered for that specialty alone. Specialty awards are available for OSCAR, SSTV, RTTY, and some of the individual VHF/UHF bands, among others. Additionally, you can get endorsement stickers for the basic WAS, including SSB, CW, QRP, moon bounce, and several others.

Too easy, you say? No problem. How about something that is 61.52 times harder to get than WAS? Is that hard enough for you? *CQ* sponsors the Worked All Counties Award (USA-CA) for making two-way contact with each of the 3076 counties in the U.S. Actually, working all of the counties could be one of the greater tests of endurance in ham radio. Organized net operation—usually on 20 meters during the day and 75 at night—makes it within the reach of a ham with average equipment. You will often find a number of mobile stations checked into the net, with their vehicle parked in such a way that the front wheels are in one county and the rear ones in another. You get two counties for the price of one. And then there is the stateside equivalent of DXpeditions; some of the DXers in Texas have been known to engage in an "Armadillo" run, where they use a well-equipped RV to drive through all the Texas counties (there's a bunch of them, obviously) in one weekend. Such activities can really accelerate your drive toward collecting all of them.

To sustain interest in the program over the long haul usually needed to reach the 3076 count, awards start at a level of 500 and are offered in increments of 500 until you reach the top. A special record book available from *CQ* for a nominal charge is required. Starting with the 1000 level, there is a minimum number of states that must be included, too. Obviously, this is an award where the card checking will be done in the field by volunteers.

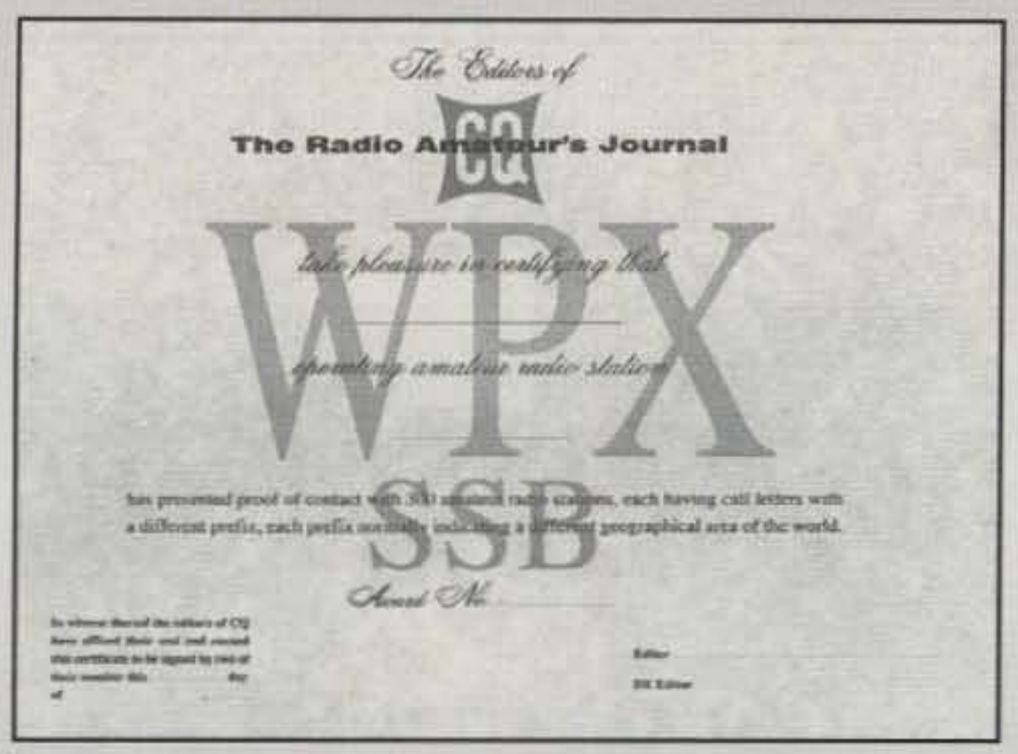
There are any number of other awards for working certain U.S. stations. Some of these are limited in time, band, and so forth, while others are more or less permanent. You have event stations commemorating (read, publicizing) state fairs, town anniversaries, and just about anything else that you can imagine someone celebrating. The "Awards" column in *CQ* mentions some of these each month along with providing updates on USA-CA. The other ham magazines highlight these secondary awards periodically, too.

DX Awards

For U.S. hams, the first flirtation with DX awards probably will center around those awards offered by *CQ* and the ARRL. The ARRL's Worked All Continents (WAC) award dates back to the earliest days of the "short wave" bands. In those days this award was a sign of true prowess as a DXer. But also in those days DX records were falling almost as fast CPU speed is increasing today. By the mid 1930s most dyed-in-the-wool DXers felt that WAC was just too easy to get. So it is today: You should be able to make the contacts for WAC in a weekend with an average station and a three-element beam.

In 1934 the publisher of *R/9* magazine, a forerunner of *CQ*, established the Worked All Zones (WAZ) award to recognize the efforts of the DX elite. The surface of the globe was divided into 40 zones. Zone boundaries have changed little since then, and WAZ has remained one of the most prestigious awards in the world of DX. It is not uncommon for a DXer to approach 200 or more countries worked before nailing that final zone. As with most other major awards, WAZ is available in several "flavors," including different modes, individual bands, and the like. Five Band WAZ (5BWAZ) is considered one of the ultimate awards in ham radio.

Shortly after WAZ was announced, the ARRL brought forth the DXCC program. Here the basic award is earned by working at least 100 countries, as defined by the ARRL



The CQ WPX award recognizes the accomplishment of confirmed QSOs with the many prefixes used by hams throughout the world.

DXCC Countries List. Currently there are approximately 300 countries on the list. Endorsements can be added until the DXer has them all—theoretically. However, there are nearly 50 deleted countries, which you can no longer work. So if you don't have them in hand, you will need to fire up your time machine.

How does a country disappear? In addition to simply disappearing (oddly enough, Atlantis does not appear on the deleted list), you have periodic political shifts and upheavals. When the Berlin Wall came down and West Germany absorbed East Germany, the old German Democratic Republic dropped off the list. Presumably, it will not return. Likewise, when the Panama Canal Zone was turned over to the government of Panama, it disappeared, too.

Some of the appearances and disappearances of countries can be attributed to revising and rewriting the DXCC rules that define *what* a country is. Today this rock is a country, but tomorrow—well, it's just another rock. It's about as complicated as the rules of golf, and the haggling sometimes reaches the intensity of a debate on impeachment. Likewise, there have been rumors and complaints of officials bending or breaking the rules for political purposes. For instance, does a reef that is only above tide four or five hours a day constitute a country? Only the DX Advisory Committee and ARRL Board of Directors know for sure.

Occasional controversy notwithstanding, DXCC has maintained a very high level of integrity down through the years. The ARRL has insisted that DXpeditions document their trips, including having all the necessary legal paperwork. If an operation is not going to be counted for DXCC credit, it loses a lot of its glamour (and potential to draw support from the amateur community).

Mixed, phone, and CW are the main flavors of DXCC, and there are ones available for individual bands, as well as satellites. Once the basic 100 countries have been worked and the certificate has been issued, endorsements are available as more countries are accumulated. Depending on the exact award and the level of countries worked, there are some restrictions on how many new ones are needed to qualify for the next endorsement level. For the basic DXCC, deleted countries do count.

DXCC also has its five-band version, 5BDXCC. Here deleted countries do *not* count. Then there is the ultimate DXCC level, the Honor Roll. To qualify for the Honor Roll you must have worked *every* country on the current list.

CQ's DX Award is similar to DXCC in that you get the basic award by working 100 countries. Here only current countries count—even for the basic award. Several endorsements are available, including certain bands, SSTV, mobile operation, and QRP, among others.

The final award I want to mention is *CQ*'s WPX. This is sort of a "fun" award that encourages general operating, because you are attempting to collect more prefixes. How many prefixes are there? Who knows? There are a lot of regular prefixes, though. Then again, special event stations often get unusual prefixes.

For more information, check the awards and DX columns in *CQ, QST,* and the other ham magazines. You can contact the ARRL directly at 225 Main St., Newington, CT 06111 (phone 860-594-0200; website: <www.arrl.org>). Contact information for *CQ*'s WAZ, CQDX, and WPX awards may be found in the "DX" column in each issue of *CQ*.

73, Pete, WB2D

Call for Photos and Stories

We'd like to hear from you about your experiences as a newcomer. If you have questions, we'll try to incorporate them into future columns. If you have photos (color prints or slides okay) of your station or antennas, please send them along and we'll publish the best ones. If you have a solution to a common problem that new hams experience, we'd like to hear about it so we can pass it along. You can contact me at <wb2d@cq-amateur-radio.com> or Peter O'Dell, WB2D, Beginner's Corner, 123 NW 13th St., Suite 313, Boca Raton, FL 33432.

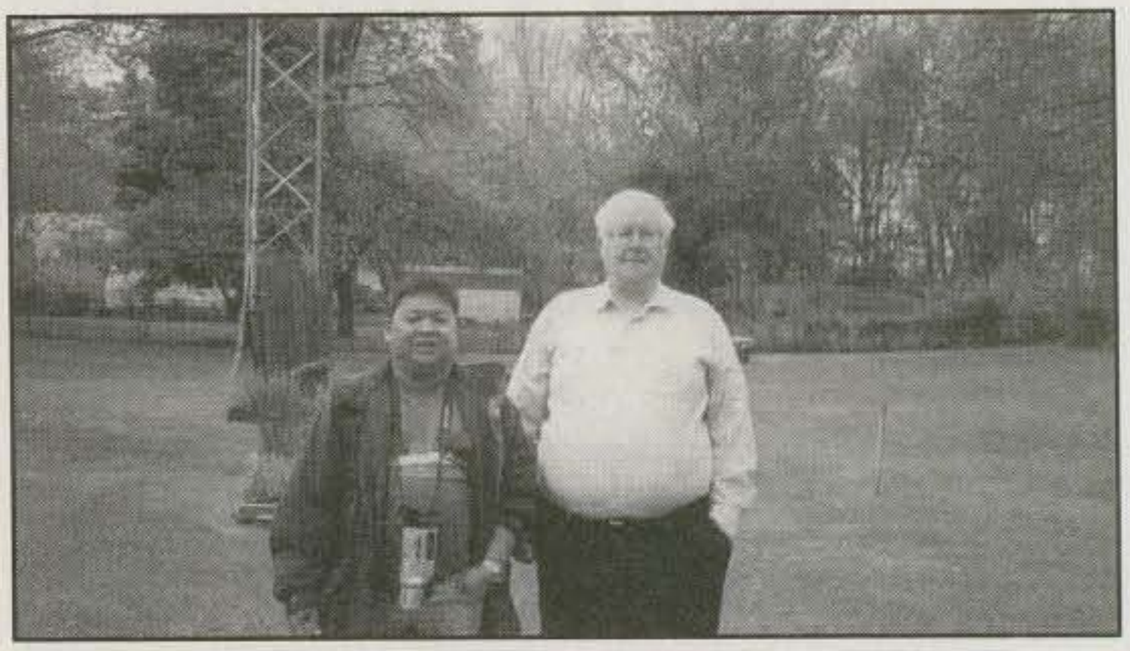
DX

BY CARL SMITH, N4AA

News Of Communication Around The World

The CQ Awards Programs . . . and more

Summer propagation has been a roller coaster with huge solar disturbances causing near-blackout conditions for some of the HF bands. Overall it has not been a "bad" year, but it certainly has had its moments of frustration for DXers.



Roger, DU1KT, visited with well-known DXer Fred Laun, K3ZO, last April. Roger and Fred are shown here in front of Fred's Rohn 80 tower. (Photo courtesy K3ZO)

Tromelin, FR/T

The French group who went to Tromelin the first of August was hit with weather problems, along with very noisy low-band conditions that hindered their operation. However, they still managed to put this difficult one in the logs of nearly 30,000 DXers in the first week of operation. The weather caused them to lose most of their generators, and the RTTY gear got hit with over 300 volts later in the week, thus ending any hope of further RTTY operation. In spite of the difficulties, they made a lot of folks happy.

Kingman Reef and Palmyra Atoll

The Kingman Reef/Palmyra DX Group will operate from Kingman Reef in early October 2000. Kingman Reef is ranked number 16 overall and after the successful A5 operation will probably move to number 2 in Europe on the most recent ARRL DXCC "Most Wanted" list.

The team is international and highly experienced in operating from locations such as this. Their experience will enhance the chances of increasing not only your total count, and but also many band/mode totals. Current team members are NI6T, N4XP, N4BQW, KH7U, NH6UY, K4UEE, WB4JTT, K3VN, W3WL, DJ9ZB, AA7A, OH2BU, WA1S (a YL), and RA3AUU. Additional team members will be added, for a total of 16 operators. Several of the ops have already operated from both Kingman Reef and Palmyra Atoll.

The operation will run for approximately 12 days in early October and will include two full weekends. Planned are six stations with amplifiers and Yagis on the high bands and Titanex and Battle Creek Special verticals on the low bands. They will also operate 6 meters, RTTY, and possibly satellite. A web site will be up and running with N1DG as the web master.

KR/PDXG team members have been operating from Palmyra Atoll since early May, as they assisted The Nature Conservancy in establishing a base camp while the Conservancy completed the final stages of its purchase of Palmyra Atoll from its private owners. Operation from Palmyra will also occur as the team stages and transits the atoll during their primary operation on Kingman Reef.

QSLing for all operations by members of the KR/PDXG is being handled via K4TSJ.

Scott, AC3A/3W2SO, recently returned from a trip to Vietnam, where he operated as 3W2SO and met several of the local hams. This photo was taken in Ho Chi Minh City. Left to right, standing: 3W6LI, 3W2SO/AC3A, 3W6AR. Seated: XV6AP/3W6JP. (Photo courtesy AC3A)

Silent Key: Lew McCoy, W1ICP

I was saddened to learn of the death of Lew, W1ICP. Quoting from the "ARRL Bulletin" of August 2: "Amateur Radio legend; former ARRL HQ staff member; past President and Director of QCWA, Lew "Mac" McCoy, W1ICP, of Mesa, Arizona, died July 31 following a lengthy illness. He was 84."

I worked with Lew at ARRL Headquarters back in 1968–70. I remember well our lunchtime card games in the shipping room. I never did figure out how he managed to win "most" of the time, but then it was a game I didn't know and he tried to teach me. Lew also introduced me to antenna tuners, and it was a subject I came to appreciate over the years. He will be missed.

Mac was a member of the ARRL staff from 1949 until 1978. He gained a national and international reputation primarily for his articles in *QST* and his early work to combat TV interference. Retired ARRL Communications Manager George Hart, W1NJM, said, "He became a hero to all the Novices

P.O. Box DX, Leicester, NC 28748-0249
e-mail: <n4aa@cq-amateur-radio.com>

The WAZ Program

Single Band WAZ

10 Meter SSB

507 ..... JH1CML 508 ..... KØDEQ

12 Meter SSB

19 ..... EA5GRB

15 Meter SSB

540 ..... JL7BRH

20 Meter SSB

1064 ..... KH6CQH 1065 ..... UA6LU

10 Meter CW

155 ..... K5MC

15 Meter CW

281 ..... I1LGR

20 Meter CW

509 ..... I1LGR

40 Meter CW

211 ..... WA7FKV

80 Meter CW

55 ..... N6AW

160 Meters

143 ... OK1DWC (31 zones) 158 ... UA0ACG (31 zones)
157 ..... W4DR (39 zones)

All Band WAZ

All CW

182 ..... JE1DRU 186 ..... I1LGR
183 ..... DL1HRY 187 ..... OK2SJ
184 ..... JA1HP 188 ..... 9A7V
185 ..... EA4TX 189 ..... JG3SKK

SSB

4570 ..... G4ZOY 4577 ..... NH6ER
4571 ..... JA6JNF 4578 ..... VP5/K7JI
4572 ..... EA5GRB 4579 ..... DS5XEH
4573 ..... I1LGR 4580 ..... JA5LI
4574 ..... W3OSE 4581 ..... WB3LTT
4575 ..... CO6XN 4582 ..... WB2OSM
4576 ..... KH6CQH

Mixed

7966 ..... W5PVE 7969 ..... KA8FSM
7967 ..... I1LGR 7970 ..... OZ2CE
7968 ..... N6BM

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, Paul Blumhardt, K5RT, 2805 Toler Road, Rowlett, TX 75089. The processing fee for all *CQ* awards is $6.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Paul Blumhardt. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. K5RT may also be reached via e-mail: <k5rt@cq-amateur-radio.com>.

and beginners because his stuff was so down to earth and easy to read."

ARRL Executive VP Dave Sumner, K1ZZ, described McCoy as "one of a kind" and "versatile." He said, "McCoy left his mark on future generations of amateurs as *QST*'s 'Beginner and Novice' editor."

McCoy was first licensed as W9FHZ and later became WØICP. He began at the ARRL in 1949 as Assistant Communications Manager for Phone and later moved to the Technical Department.

The WPX Program

CW

3043.....DL9GTK 3044.....W3BM

SSB

2753.....RU1AB 2755.....F5JSK
2754.....JQ1CJF

Mixed

1860 .....LU7HNN

CW: 350 DL9GTK, W3BM. 400 DL9GTK, W3BM. 450 DL9GTK, W3BM. 500 DL9GTK, KU6J, W3BM. 550 DL9GTK, KU6J. 600 DL9GTK, KU6J. 650 AGØA, KU6J. 750 AI9L. 1300 KT2C.

SSB: 550 KU6J. 600 KU6J. 650 KU6J, F6FYD, EA5GMB. 700 KU6J, F6FYD, EA5GMB. 750 F6FYD, EA5GMB. 800 F6FYD, EA5GMB. 850 F6FYD, EA5GMB. 900 F6FYD, EA5GMB. 950 F6FYD, EA5GMB. 1000 F6FYD. 1050 F6FYD. 1100 F6FYD. 1150 F6FYD. 1200 F6FYD. 1250 F6FYD. 1300 F6FYD. 1350 F6FYD. 1400 F6FYD. 1450 F6FYD. 1500 K9GWH. 1650 LU5DV. 1700 LU5DV. 2750 LU8ESU.

MIXED: 800 KU6J. 850 KU6J. 900 KU6J. 1000 KU6J. 1500 K9GWH. 2650 N4UH.

10 meters: JQ1CJF, KU6J
20 meters: W3BM
40 meters: KU6J
80 meters: KU6J

Asia: JQ1CJF, W3BM
Africa: KT2C
N. America: W3BM
Europe: KU6J
Oceania: KU6J

Award of Excellence Holders: K6JG, N4MM, W4CRW, K5UR, K2VV, VE3XN, DL1MD, DJ7CX, DL3RK, WB4SIJ, DL7AA, ON4QX, 9A2AA, OK3EA, OK1MP, N4NO, ZL3GQ, W4BQY, IØJX, WA1JMP KØJN, W4VQ, KF2O, W8CNL, W1JR, F9RM, W5UR, CT1FL, W8RSW, WA4QMQ, W8ILC, VE7DP, K9BG, W1CU, G4BUE, N3ED, LU3YL/W4, NN4Q, KA3A, VE7WJ, VE7IG, N2AC, W9NUF, N4NX, SMØDJZ, DK5AD, WD9IIC, W3ARK, LA7JO, VK4SS, I8YRK, SMØAJU, N5TV, W6OUL, WB8ZRL, WA8YM, SM6DHU, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, DK4SY, UR2QD, ABØP, FM5WD, I2DMK, SM6CST, VE1NG, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, HA8XX, K7LJ, SM3EVR, K2SHZ, UP1BZZ, EA7OH, K2POF, DJ4XA, IT9TQH, K2POA, N6JV, W2HG, ONL-4003, W5AWT, KB0G, NB9CSA, F6BVB, YU7SF, DF1SD, K7CU, I1PO, K9LNJ, YBØTK, K9QFR, 9A2NA, W4UW, NXØI, WB4RUA, I6DQE, I1EEW, I8RFD, I3CRW, VE3MC, NE4F, KC8PG, F1HWB, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, KC7EM, YU1AB, IK2ILH, DEØDAQ, I1WXY, LU1DOW, N1IR, IV4GME, VE9RJ, WX3N, HB9AUT, KC6X, N6IBP, W5ODD, IØRIZ, I2MQP, F6HMJ, HB9DDZ, WØULU, K9XR, JAØSU, I5ZJK, I2EOW, IK2MRZ, KS4S, KA1CLV, KZ1R, CT4UW, KØIFL, WT3W, IN3NJB, S50A, IK1GPG, AA6WJ, W3AP, OE1EMN, W9IL, S53EO, DF7GK, I7PXV, S57J, EA8BM, DL1EY, KØDEQ, KUØA, DJ1YH, OE6CLD, VR2UW, 9A9R, UAØFZ, DJ3JSW, HB9BIN, N1KC, SM5DAC, RW9SG, WA3GNW, S51U, W4MS, I2EAY, RAØFU, CT4NH, EA7TV, W9IAL, LY3BA.

Award of Excellence with 160 meter Endorsement: K6JG, N4MM, W4CR2, N5UR, VE3XN, DL3RK, OK1MP, N4NO, W4BQY, W4VQ, KF2O, W8CNL, W1JR, W5UR, W8RSW, W8ILC, G4BUE, LU3YL/W4, NN4Q, VE7WJ, VE7IG, W9NUF N4NX, SMØDJZ, DK3AD, W3ARK, LA7JO, SMØAJU, N5TV, W6OUL, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, UR1QD, AB9O, FM5WD, SM6CST, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, K7LJ, SM3EVR, UP1BZZ, K2POF, IT9TQH, N8JV, ONL-4003, W5AWT, KBØG, F6BVB, YU7SF, DF1SD, K7CU, I1POR, YBØTK, K9QFR, W4UW, NXØI, WB4RUA, I1EEW, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, YU1AB, IK4GME, WX3N, WBØDD, IØRIZ, I2MQP, F6HMJ, HB9DDZ, K9XR, JAØSU, I5ZJK, I2EOW, KS4S, KA5CLV, KØIFL, WT3W, IN3NJB, S50A, IK1GPG, AA6WJ, W3AP, S53EO, S57J, DL1EY, KØDE1, DJ1YH, OE6CLE, HB9BIN, N1KC, SM5DAC, S51U, RAØFU, UAØFZ, CT4NH, W1CU, EA7TV, LY3BA.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if airmail desired) to "CQ WPX Awards," P.O. Box 593, Clovis, NM 88101 USA.

ARRL Lab Supervisor Ed Hare, W1RFI, credited McCoy with providing the foundation for the ARRL's current RFI expertise. Mac was well-known for one his projects in particular, "The Ultimate Transmatch," an antenna tuner that he described first in a July 1970 article in *QST*.

After leaving the ARRL, Mac continued as a contributing editor for *QST* and was a major contributor to other publications, including *CQ*.

Memorial donations may be made to Hospice of the Valley, 1510 E. Flower Street, Phoenix, Arizona 85014-5656.

CQ Awards Programs

A reader recently sent me a note asking about all of the awards tables in this column. Most of you are familiar with the various award programs sponsored by *CQ*, but there are a lot of new folks who might not know what they are, or the story behind them. This month I would like to use some space to briefly describe the various programs and possibly generate some interest/activity by more of the newer DXers.

The WPX Award. The CQ WPX Award recognizes the accomplishments of confirmed QSOs with the many prefixes used by amateurs throughout the world. Separate, distinctively marked certificates are available for SSB, CW, and Mixed (CW and SSB/Phone). The program is administered by WPX Awards Manager, Norm Koch, WN5N, in Clovis, New Mexico.

Certificates are issued for HF (160–10 meters) for the following modes and number of prefixes: Mixed (CW and SSB/Phone only) 400 prefixes confirmed; CW 300 prefixes confirmed; SSB 300 prefixes confirmed. Separate applications are required for each mode.

Endorsements are issued for each additional 50 prefixes submitted. Band endorsements are available for the various bands: 160 meters, 50; 75/80 meters, 175; 40 meters, 250; 20 meters, 300; 15 meters, 300; and 10 meters, 300.

Endorsements are also available for working prefixes in the respective continents: North America,160; South America, 95; Europe, 160; Africa, 90; Asia, 75; and Oceania, 60.

There is a WPX Honor Roll recognizing operators/stations and it requires a minimum of 600 prefixes.

The WPX Award of Excellence is the ultimate award for the prefix DXer. It requires 1000 prefixes in Mixed mode, 600 prefixes in SSB, and 600 in CW, all six continental endorsements and the

five band endorsements 80–10 meters. A special 160 meter endorsement bar is also available.

The Worked All Zones (WAZ) Award. One of the most sought after awards is WAZ. It is issued to any licensed amateur station presenting proof of contact with all 40 of the *CQ* zones of the world. Application form, rules, and a zone map are available in PDF format from the *CQ* web page <www.cq-amateur-radio.com/wazrules.html>. It is one of the longest running awards programs, having started prior to WW II. It is geographically focused, involving the use of DX entities, but not relying on any particular entity's status as a country. This program is administered by Paul Blumhardt, K5RT, of Rowlett, Texas.

5 Band WAZ

As of June 30, 2000, 531 stations have attained the 200 zone level and 1143 stations have attained the 150 zone level.

New recipients of 5 Band WAZ with all 200 zones confirmed:
None

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)
W4LI (AA4KY), 199 (26)
K7UR, 199 (34)
WØPGI, 199 (26)
W2YY, 199 (26)
VE7AHA, 199 (34)
IK8BQE, 199 (31)
JA2IVK, 199 (34 on 40m)
ABØP, 199 (23)
KL7Y, 199 (34)
NN7X, 199 (34)
OE6MKG, 199 (31)
IK1AOD, 199 (1)
DF3CB, 199 (1)
F6CPO, 199 (1)
W3UR, 199 (23)
KC7V, 199 (34)
GM3YOR, 199 (31)
VO1FB, 199 (19)
KZ4V, 199 (26)
W6DN, 199 (17)
W6SR, 199 (37)
W3NO, 199 (26)
K4UTE, 199 (18)
K4PI, 199 (23)
HB9DDZ, 199 (31)
N3UN, 199 (18)
K4IQJ, 199 (23)
K3NW, 199 (23)
UA3AP, 199 (6)
OH2VZ, 199 (31)
K2UU, 199 (26)
W1FZ, 199 (26)
K9GX, 199 (26)
NT5C, 199 (18)
UT4UZ, 199 (6)
EA5BCK, 198 (27,39)
G3KDB, 198 (1,12)
KG9N, 198 (18,22)
KØSR, 198 (22,23)
UA4PO, 198 (1,2)
JA1DM, 198 (2,40)
9A5I, 198 (1,16)
K4ZW, 198 (18,23)
LA7FD, 198 (3,4)
K5PC, 198 (18,23)
VE3XO, 198 (23,23 on40)
K4CN, 198 (23,26)
KF2O, 198 (24,26)
W6BCQ, 198 (37,34on40)
G3KMQ, 198 (1, 27)
DL3JJ, 198 (19&31 on 10)
W5BOS, 198 (18,23)

The following have qualified for the basic 5 Band WAZ Award:

****Please note: Cost of the 5 Band WAZ Plaque is $80**

Endorsements:
K1ST (200 zones)
K9YY (200 zones)
KUØA (190 zones)
UT4UZ (199 zones)
HC8N (186 zones)
OE2BZL (194 zones)

($100 if airmail shipping is requested).

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, Paul Blumhardt, K5RT, 2805 Toler Road, Rowlett, TX 75089. The processing fee for all *CQ* awards is $6.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Paul Blumhardt. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. K5RT may also be reached at e-mail: <k5rt@cq-amateur-radio.com>.

CQ DX Awards Program

SSB

2313.....VU2FOT 2314.....WA2RZJ

CW

1011.....W5IBZ 1012.....WA2RZJ

SSB Endorsements

320.....XE1VIC/331
320.....OE2EGL/329
320.....VE2GHZ/328
320.....W9IL/323
320.....PY2DBU/322
320.....EA7TV/320

CW Endorsements

320.....W4OEL/331
320.....LA7JO/324
275.....W9IL/282
150.....WA7SNY/175

RTTY Endorsements

310.....K3UA/313

The basic award fee for subscribers to *CQ* is $6. For nonsubscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business-size, No. 10, self-addressed, stamped envelope to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. Currently we recognize 331 active countries. Please make all checks payable to the award manager.

The WAZ Award is available by mode and band. There are special endorsements available for such things as QRP or mobile. There is also a 5 Band WAZ award available for contacting the 40 zones of the world on the 80, 40, 20, 15, and 10 meter bands.

The CQ DX Award. This award is issued in three categories— CW, SSB, and RTTY—for proof of two-way contact with 100 or more countries. Additional country endorsements are available for all of these awards. There are also special endorsements for 10, 40, 80, and 160 meters; QRPp; Mobile; SSTV; and OSCAR. The CQ DX Honor Roll lists all stations with a total of 275 or more active countries.

USA-CA Award. CQ's USA counties award is one of the most challenging awards there is, with the ultimate goal of making confirmed contacts with all 3076 counties in the United States. The initial award is for 500 counties confirmed, with endorsements available for each subsequent group of 500. If you noticed last month's *CQ* cover and "Awards" column, you'll note that the number of hams working all 3076 counties has just passed the 1000 mark.

QSL INFORMATION

3A2K to 3A2ARM
3C2JJ to F2XX
3D2QB to SM3CER
3D2RK to W7TSQ
3D2RW to ZL1AMO
3D2SQ to W7TSQ
3D2ZC to AA1ON
3DAØCF to K5LBU
3DAØEW to K5LBU
3W2KYU to JH8KYU
3W2LC to VK6LC
3W6KM to ES1AKM
3W7CW to SP5AUC
3W7TK to OK1HWB
3XY2D to VE2DPS
3ZØEMC to SP6ECA
3Z3JPL to SP3PDV
3Z6ØW to SP2BNJ
3Z6IEQ to SP6IEQ
4B1AC to XE1BEF
4F7/SM3SGP to SM3EVR
4K1F to UT5UGR
4L26MAY to 4L1DA
4L4KW to KE1HZ
4L4MM to ON4CFI
4O8/9XØA to RW3AH
4S7BRG to HB9BRM
4S7UB to KJ6UB
4S7YSG to JA2BDR
4W/K7BV to KU9C
4WØAI to CT1EGH
4W6GH to CT1EGH
5C8A to EA5XX
5C8M to DL6FBL
5H3US to WA8JOC
5I3A to A47RS
5I3B to A47RS
5N4BFD to DJ9FH
5R8DS to PA3BXC
5R8FL to F5TBA
5V7MD to K7PT
5X1Z to SM6CAS
6Y5MM to W4YCZ
6Y8A to WA4WTG
7A5DX to YBØAI
7P8AA to DL7VRO
7Q7TB to G3TBK
7S2A to SM2LWU
7S2E to SM2DMU
8J7WGC to JARL
8M2ØØØ to JARL
8P6FI to 8P6FI
8P9JL to OH6RX
8P9V to OH6RX
8Q7KK to HA2SX
8S7A to W3HNK
8S7IPA to OZ5AAH
9E1C to IV3OWC
9G5ZW to OM3LZ
9J2FR to IK2RZQ
9K2SS to KB2MS
9M2TO to JAØDMV
9M2XA to JF4WPQ
9M6CT to G4JMB
9M8QQ to DF5UG
9N1AC to N3ME
9N1VJ to JA9VJ
9N7IP to JG5CIP
9N7VN to K3VN
9V1XE to DL4DBR
A35MQ to DL8NBE
A45ZN to GØDBX
A52A to WØGJ
A52NL to JA6NL
A61AO to N1DG
A61AT to IT9ZGY
AJ2U/VP9 to KQ3F
BTØQGL to KQ6PS
BV9G to BV8BC
BX4AL to W3HC
C21JH to VK2GJH
C6AKA to DL7VOG
C6DX to W8GEX
CN8LI to ON4ANT
CN8WW to DL6FBL
CO8LY to EA7ADH
CO8TW to EA3FQV
CT3KN to CS3MAD
CT9KN to CT3KN
CV7V to CX4ACR
CW6V to W3HNK
D3SAF to I3LLH
D68TA to JA1IDY
DN1VA to DJ9VA
ED1ONS to EC1BXI
ED5SJF to EA5URL
EMØHQ to UX2MM
EM3J to KG6AR
EM7ØDXG to UT1WA
EN5J to KG6AR
EO55FI to UX3FW
EO55HK to UT1HT
EO55IX to UR6IM
EO55JM to KG6AR
EO55ZN to UYØZG
EP1DX to DL1EL
EP2AC to RV6AB
ER4DX to UT7ND
ER6A to ER1LW
EY/ON6TT to ON5NT
EY8MM to K1BV
EZ3A to EZ8CW
F5KEE/FY to F8BXI
FK8HW to VK4FW
FOØDER to 3D2AG
FOØMOT to OM2SA
FOØPT to DJØFX
FOØSPE to KG6AR
FO8DX to KG6AR
FP5DX to TK5NN
FW/G4DZC to AA1ON
FY/F5KEE to F8BXI
GDØKRL to GØKRL
GM2T to GMØALS
GS3EEO/P to G3OCA
GUØVJG to GØVJG
GWØWGW to GWØMOW
H4ØMY to JAØIXW
HC4WW to UA4WAE
HI3/YT1CS to YZ1GD
HL2ØOO to HL5AP
HO3A to HP3XUG
HSØØ/G4DZC to AA1ON
HSØZAC to KO6H
HSØZCP to KS7K
IH9/OL5Y to OK1MG
IRØAD to IØNNY
IR3BZ to IN3DEI
J27JUIN to F5IPW
J28EW to F5LDY
J28NH to F5IPW
J37K to W8KKF
J43O to SV3AQR
J68AK to W8QID
J68AM to W8ILC
J68DD to N6JRL
J68TD to KD4YHY
J75KG to N2AU
3DAØMA – July 21-Aug 13, 2000 to Maurice Andries, ON4BAM, Molenstr 74, B-9200 Dendermonde, OV, Belgium
3F1BYS to Elio Salinas, Box 10745, Panama 4, Panama
3F3A to Louis N. Anciaux, PSC 2 Box R3197, FPO AA 34002, USA
3F3XUG to Louis N. Anciaux, PSC 2 Box R3197, FPO AA 34002, USA
3V8BB – May 27/28, 2000 via YT1AD, Hranislav Milosevic, Lenjinov Bulevar 10-E 254, 11070, Novi Beograd, Yugoslavia
4S7WN to Dr. Nihal G. Wijesooriya, 44-1/1 Ward Place, Columbo 7, Sri Lanka (Use oversize return envelope, big card.)
5B4AGX to Mike Potter, Box 60195, CY-8128 Paphos, Cyprus
5NØWFU to Box 1509, Wiesbaden, Germany
5Z4FM to James Stewart, POB 63363, Mathaiga, Nairobi, Kenya
6K5SSR to Lee Jong-Min, Box 65, Taegu Susung 706-600, South Korea
6W6JX to Jean-Louis Pipien, Box 10, Kaolack, Senegal
8P6GH to Kelvin Went, Box 150E, St. Michael, Barbados
9N1AA – JA's via JM1HBO, aAll others via N4AA
A41LK to Fahad, P.O. Box 509, Sohar 311, Oman
A41MD to Jeifar Abdullah al-Habsy, Box 1823, Seeb 111, Oman
A43IB to The Royal Omani Amateur Radio Society, Box 981, Muscat 113, Oman
A51TY to T. Yonten, Headquarters Royal Bhutan Wireless, Post Office Thimphu, Bhutan
A71EZ to Saleh M Al Qahtani, POB 12170 Doha, Qatar
A71MA to Shk Mohd Bin Abdul Aziz Al-Thani, POB 24545, Doha, Qatar
AP2ARS – May 13/14, 2000 to ON5NT, Ghislain Penny, Lindestraat 46, B-9880 Aalter, OV, Belgium
AP2ARS to Pakistan AR Soc, POB 1450, Islamabad 44000, Pakistan
AP2N to KU9C
BD4AGN to Room 403, No. 35, Village 14 of Tianlin, Xuhui,Shanghai 200233, China
BD7KU to Yi Quan, 131 Xian Lie Dong Road, Guangzhou 510500, China
BD7YC to Dick Hisan, Box 59, 16 Datung Avenue, 570102 Haukou, Hainan, China
BV2A to T. Chen, POB 30-547, Taipei, Taiwan
C6AJR – July 28-31, 2000 via W8GEX
C91DC for USA, Brian Carney, DOS/PC – Maputo, 2201 C St., Washington, DC, 20521-2330, USA
C91DC all others via Brian Carney, c/o US Embassy, P.O. Box 783, Maputo, Mozambique, Southern Africa
CEØZIS to Eliazar Pizarro Rojas, POB 1, Robinson Crusoe Island, Chile
CS1GDX/P to P.O. Box 56, 2736-901 Cacém , Portugal
CX1JJ to P.O. Box 68164, 50000 Salto, Uruguay
CX1JK to P.O. Box 68164, 50000 Salto, Uruguay
CX3JE to P.O. Box 68164, Salto 50000 Uruguay
D44BC – Julio Vera-Cruz, Silent Key on 10/13/99. QSL cards are being returned.
DL2MEH to Manfred Wolf, Lattenweiler 58, D-88131 Lindau, Germany
DU9RG to Robin Go, 818 Acacia Ave., Ayala Alabang Village, Muntinlupa City 1780, Philippines

The USA-CA Award is administered by Award Manager Ted Melinosky, K1BV, and updates on participants are published regularly in Ted's "Awards" column here in *CQ*.

More complete information on all of the above awards is available on the *CQ* web site or by contacting the respective award manager.

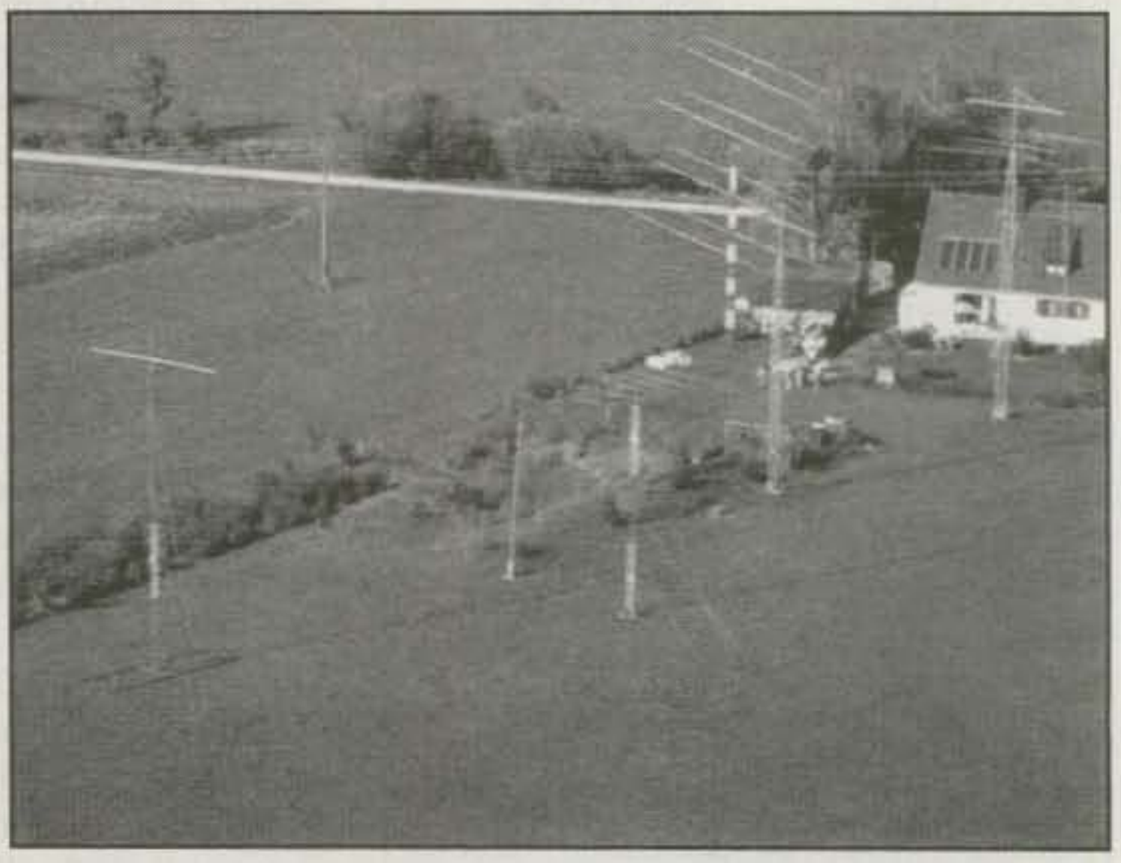
Most Wanted Survey

I would like to call to your attention the survey conducted each year by *The DX Magazine*. This is a very popular source of information for future DXpeditioners. The survey is available on-line at <www. dxpub.com> until October 15, 2000. The results of the survey will be published in the January/February 2001 issue of *The DX Magazine*. If you don't have access to the internet, you can contact me for a printed copy, but remember the October 15th deadline.

Some of you may note that the WPX Honor Roll is missing from the column this month. We couldn't make the deadline this month, but it will be back in the December issue.

Until next time, Good DXing, and remember . . . It's a hobby—have fun!

73, Carl, N4AA



Helmut, DL7MAE, along with his "ham" family (DL7MAT, DL5MAE, DL3MAA, DH5MBB, and DN1MA) share the pleasure of operating from this impressive layout. (Photo courtesy DL7MAE)

Our Readers Say

Field Day Bonus Points

Editor, *CQ*:

I read WA3PZO's "Public Service" column about ARRL Field day bonus points in the June issue. We followed your advice and completed several requirements for bonus points this year. Thanks to Bob for his help. We also had a first for our small group (only three guys) this year. We got a local business at the airport where we set up (Camarillo, California) to donate use of their jet helicopter and pilot to put a line over an 85 foot tall lamp post so that we could hoist up our wire antennas.

Ed Rogoff, K6RSD
via e-mail

Ham Internet

Editor, *CQ*:

I read your editorial in the June issue with interest. 56Kbps packet has been a reality in the Vancouver, BC area for almost five years. We have two repeaters that have coverage throughout our region, and even down to the Seattle, Washington area. We provide service to local hams and the emergency management community, including the provincial and federal emergency management agencies.

TCP/IP and internet-based tools and techniques such as SMTP e-mail, ftp, telnet, web servers, the MBone, and streaming video have been used on the 56K network up here for years! In fact, I'm writing this with Eudora, my Win NT machine being linked to a 56K Linux router in my basement, and from there on 430/439 MHz through a local 56K repeater, to our internet gateway at Simon Fraser University.

You can ping my router at 207.23.85.11. You'll be getting out onto the 56K network to do so. WA7TAI is at 207.23.85.16, he's interlinked with 44 net, the amateur radio subnet, via (I think) 9600 bps. This project is part of a larger research program into emergency communications and applications of new technologies. Check out one of our web pages at <http://hoshi.cic.sfu.ca/epix/vemis>, it gives details about the project, although it's a bit out of date. I'd be pleased to provide you with further information on this project if you're interested.—73, I enjoy your magazine.

Kevin McQuiggin, VE7ZD
via e-mail

Kevin: Thank you for bringing us up to date on what's happening with amateur digital communications in Vancouver. We are definitely interested in hearing more about this. It appears that once again, hams in Vancouver may have something very valuable to contribute to the advancement of amateur radio. (For those of you who don't recall the last time, it was the folks in the Vancouver Amateur Digital Communications Group who in the early 1980s developed the first practical packet TNC and the predecessor to the AX.25 packet protocol used today.)

Not Only for the "Big Guns"

The following letter was sent to CQ's "Contesting" Editor, John Dorr, K1AR.

Hi, John:

I am a long-time reader of your column and want to take this opportunity to say thanks for providing so much good information to those of us who are not "Big Gun" contesters. I finished reading your May column and can readily identify with Sam Moore, K7SAM.

While my contesting efforts are non-competitive in nature (I don't enter to win.), I do find going head-to-head with the rest of the "Big Guns and Little Pistols" is a lot of fun. Primarily, I use contesting as a way to boost my DXCC totals.

Keep up the good work in CQ. I look forward to your column each month.

Rich Arland, K7SZ
via e-mail

Announcements *(from page 10)*

Oct. 21–22, **Phil-Ham-Expo 2000**, a philatelic exhibition on the radiocommunication theme during Ham Expo, Auxerre, France. Contact Raymond Aupetit, Boite Postale 1392, F-16017 Angouleme, Cedex, France; <raymond.aupetit@wanadoo.fr>.

Oct. 28, **Greater Jacksonville Hamfest**, Morocco Shrine Auditorium, Jacksonville, Florida. Contact Jeff Greer, WD4ET, 904-613-7427; <http://www.ccse.net/~lrich/jaxhamfest.html>. Talk-in 146.76. (Exams)

Oct. 28, **Halloween Hamfest**, Kirkwood Community Center, St. Louis County, Missouri. Contact Steve Welton, WBØIUN, 9847 Arv-Ellen, St. Louis, MO 63123 (314-638-4959; <slw@partyline.net>. Talk-in 146.91.

Oct. 28–29, **LARA Hamfest & Computer Show**, Olde Mill Stream RV Resort, Umatilla, Florida. Contact Chuck Crittenden, KE4EXM, P.O. Box 615, Altoona, FL 32702 (352-669-2075; <capias@gate.net>). Talk-in 147.255. (Exams 10 AM)

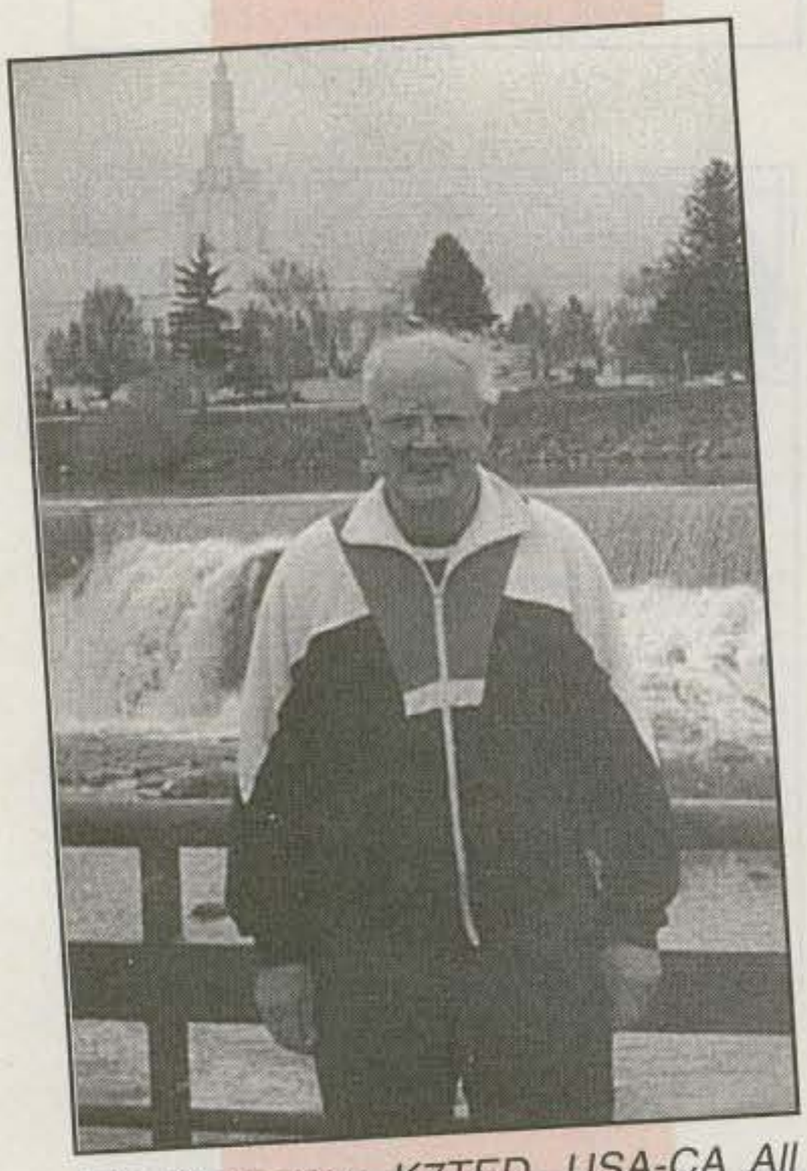
Oct. 29, **Massillon ARC Hamfest**, Stark County Fairgrounds, Canton, Ohio. Contact Terry Russ, N8ATZ, 3420 Briardale Cr., Massillon, OH 44646 (330-837-3091); e-mail: <marchamclub@juno.com>; <www.qsl.net/w8np>. Talk-in 147.18+.

Oct. 29, **Great South Bay ARC Hamfest**, Knights of Columbus, Lindenhurst, Long Island, New York. Contact Hamfest October 2000, P.O. Box 1356, West Babylon, NY 11704. Talk-in 146.685 -600, PL 136.5.

Awards

BY TED MELINOSKY, K1BV

News Of Certificate And Award Collecting



Bill Carpenter, K7TED, USA-CA All Counties #1001.

Bill Carpenter, K7TED, USA-CA All Counties #1001, was first licensed in 1962 as a Novice. He became an Extra in 1977. Bill has earned the WAS and 5BWAS awards, and needs three countries to make the Honor Roll.

In February 1998 Bill began working counties fixed and mobile. He started with 600 counties to his credit. When mobile, his wife drives while he logs the contacts. Bill says this is a great hobby and he has met many friendly, courteous, helpful people on the air. He is now working on the second time around and is looking forward to seeing more of the country. Congratulations, Bill!

USA-CA Questions Answered

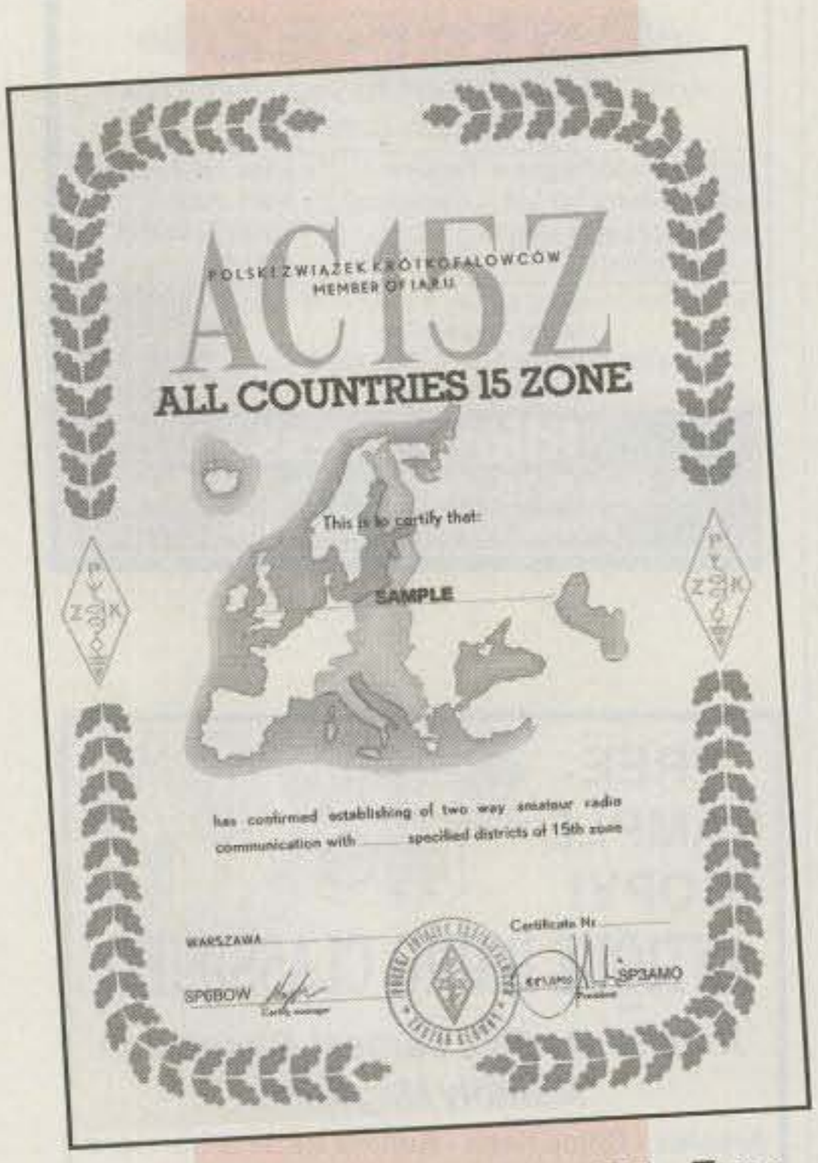
We often receive questions about the USA-CA program via e-mail. Here are just a few.

Is USA-CA available for SWLs? Yes. Use the same rules as those published for licensed amateurs. If you later earn your amateur license, you will be able to continue the SWL award on the same basis as well as start a separate award for two-way contacts.

How do I verify counties from QSLs that don't have the county name written or printed on the card? The county name does not have to be written on the card. You may use any reliable reference publication such the US Postal Service website, a road map, or an encyclopedia.

Do I have to use CQ's official county Record Book? No, the program will accept any computer-prepared list as long as it contains at least as much data as the official booklet. This means that the list must be by state, and list all counties claimed in alphabetical order. Each contact should show callsign, city/town (or "mobile"), band, and mode.

What is the fee for USA-CA applications? Actually, this wasn't an actual question, but the new information came from *CQ* headquarters and this is the best way to tell you about it. The fee for the award is now $US12 for non-subscribers and $US6 for subscribers.



The All Countries of the 15th Zone Award is issued by PZK, the Polish national amateur radio organization.

DX Awards

The DARC Millennium Award. Okay, the year 2000 is coming to an end in just a few months. If you've been at all active, you've had the chance to work a number of the commemorative Y2K stations. Here's another such award in which you might be interested.

This award is issued by the German DARC division A20. Work six (three on VHF) different special event stations which are active in commemoration of the new millennium—i.e., DL2OOO and ZL2OOO (the suffixes are "O"s, and not zeroes). SWL okay. Contacts after 1 September 1997 count. No band or mode restrictions. Send GCR list and fee of $US10 to Horst Poelitz, Postfach 1213, D-68537, Heddesheim, Germany. This is a very handsome certificate; an image of it may be viewed at the DARC website: <http://www.darc.de/distrikte/a/dl2000.htm>. (The fee for the diploma may also be transferred to the award manager's bank account: Raiffeisenbank Heddesheim, Sorting Code 670 614 26, Account No. 970700.)

Polski Zwiazek Krotkofalowcow (PZK) Series. This award series comes from the Polish national amateur organization "PZK." I've found that Polish stations are excellent QSLers. (Maybe it's my last name, but how would they know?) They also are very good about identifying their province, or powiat, on the cards. This makes determining information for several of their awards quite easy. PZK also sponsors an annual contest which can be an extremely valuable source of contacts for all of their awards.

USA-CA Honor Roll

1000

G3LAS.....1550
JE1REU.....1551

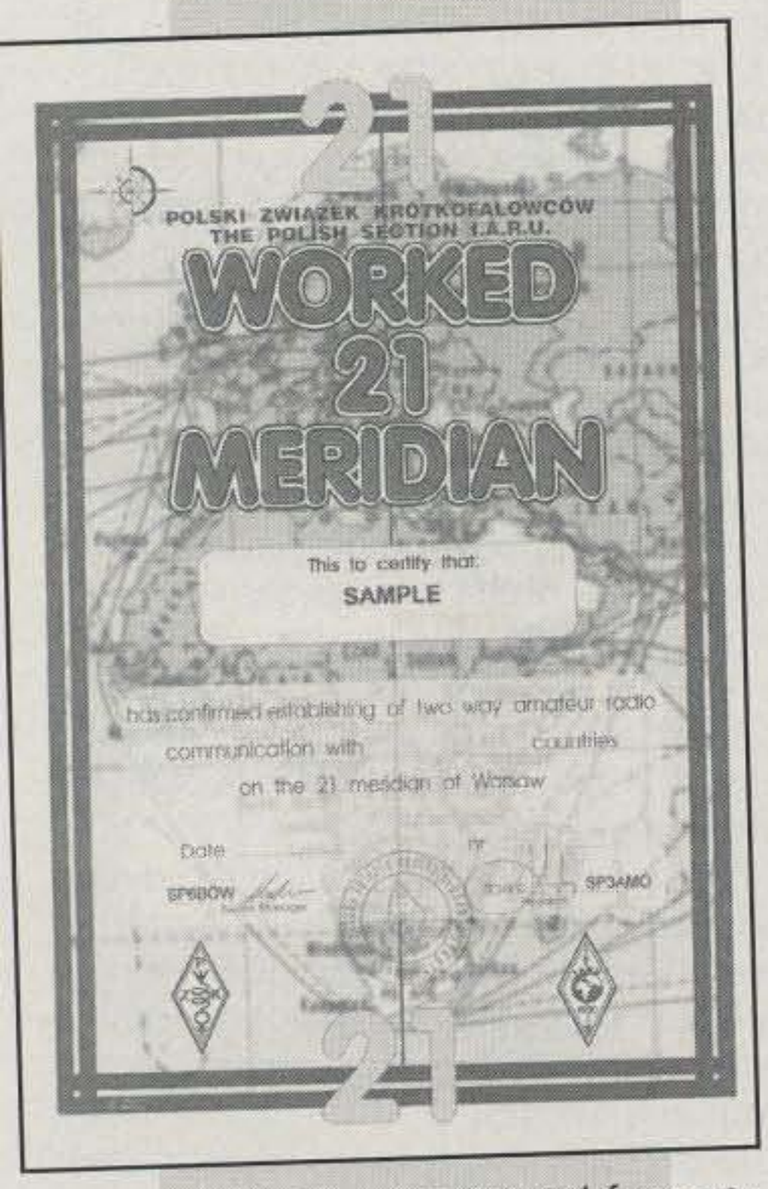
1500

G3LAS.....1291

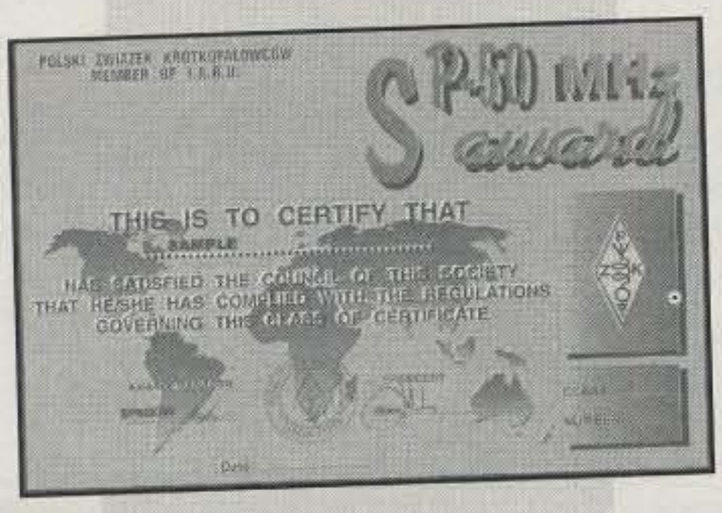
The total number of counties for credit for the United States of America Counties Award is 3076. The basic award fee for subscribers is $6.00. For nonsubscribers it is $12.00. To qualify for the special subscriber rate, please send a recent CQ mailing label with your application. Initial application may be submitted in the USA-CA Record Book, which may be obtained from CQ Magazine, 25 Newbridge Road, Hicksville, NY 11801 USA for $2.50, or by a PC-printed computer listing which is in alphabetical order by state and county within the state. To be eligible for the USA-CA Award, applicants must comply with the rules of the program as set forth in the revised USA-CA Rules and Program dated June 1, 2000. A complete copy of the rules may be obtained by sending an SASE to Ted Melinosky, K1BV, 65 Glebe Road, Spofford, NH 03462-4411 USA. DX stations must include extra postage for airmail reply.

65 Glebe Road, Spofford, NH 03462-4411
e-mail: <k1bv@cq-amateur-radio.com>

To earn PZK's Powiat Award you must contact at least 100 different small districts of Poland.



The W-21-M Award is issued for contacts with at least 16 countries located on the 21st East Meridian.



The SP – 50 MHz Award is another in the series of awards offered by PZK.

General Requirements: Awards are available to licensed amateurs or SWLs. Price for each award is DM10, $US7, or 10 IRCs. All contacts, with the exception of satellite or repeaters, regardless of band or mode, are valid for their awards. You must possess the QSLs, but the GCR rule applies. Apply to: PZK Awards Manager, Augustyn Wawrzwnek, SP6BOW, P.O. Box 42, PL-64-100 Leszno 7, Poland.

All Countries of the 15th Zone. Contact at least 23 countries/call areas located in *CQ* Zone 15. Contacts with four call areas of Poland are mandatory. Your list should be in alphabetical order. Contacts after 1 January 1955 are valid.

CQ Zone 15: Aland Is. OHØ, Kaliningradsk UA2, Albania ZA, Latvia YL, Austria OE (two call areas), Lithuania L, Malta 9H, Bosnia T9, Market Reef OJØ, Corsica TK, Poland SP (four call areas), Croatia 9A, Czech Rep. OK, San Marino T7, Estonia ES, Sardinia IS, Finland OH (three call areas), Sicily IT, Hungary HA, Slovenia S5, Italy I, Vatican City HV, Macedonia Z3, Yugoslavia YU (three call areas), Slovenia OM.

Powiat Award. Contact at least 100 different "powiats" (small districts) since 1 January 1999. Endorsements for each additional 100 districts. All bands and modes. Crossband QSOs and ground or satellite repeaters do not count. Special endorsement for use of one mode, and special endorsement for contacting all 373 powiats. On VHF, the basic award is available for contacting 50 different powiats in at least three different SP call areas. SWL okay. The Polska award for provinces has been replaced by the Powiat award. (A list of the powiats is on the PZK website at: <http://www.pzk.org.pl/dyp_ang.htm>. This is a *huge* undertaking, as there are almost 400 of these little subdivisions, as compared to the 49 provinces.

W-21-M. This award isIssued for contacts with at least 16 countries located on the 21st East Meridian. QSO with Poland is mandatory. Contacts since 1 January 1955 are valid. Submit the list in alphabetical order.

Countries list: Aland Is. OHØ, Latvia LY, Angola D2, Libya 5A, Botswana A2, Lithuania LY, Central African Rep. TL8, Namibia/SWA ZS3/V5, Chad TT8, Norway LA, Czech Republic OK, Poland SP5, Estonia ES, Rep. of South Africa ZS2-6, Finland OH, Rep. of Zaire 9Q, Greece SV, Romania YO, Hungary HA, Slovak Rep. OM, Kalingradsk UA2, Svalbard JW, Albania ZA, Sweden SM, Macedonia Z3, Yugoslavia YU.

SP 50 MHz Award. The award is available in three classes:

The Johannes Paulus II Award commemorates the pilgrimages of Pope John Paul II.

Class 1—confirmed contacts with 10 SP's in 6 middle field locator.

Class 2—confirmed contacts with 20 SP's in 12 middle field locator.

Class 3—confirmed contacts with 30 SP's in all SP call areas 1–9 and 20 middle field locator. Contacts since 1 January 1995 are valid. All modes.

Pilgrimages of the Holy Father (Johannes Paulus II) Award. Commemorates the pilgrimages of Pope John Paul II. Contact stations in countries visited by the Pope since 16 October 1978. No use of repeaters. Prefixes of valid countries are shown below. The award classes are as follows:

HF—Class I for QSOs in at least 110 countries; Class II for QSOs in at least 75 countries; Class III for QSOs with at least 50 countries.

VHF—Class I for QSOs with at least 15 countries; Class II for QSOs with at least 10 countries; Class III for QSOs with at least 5 countries.

On HF, contacts with Poland and Italy are required.

Country List: A2, AP, C5, C9, CE, CN, CO, CP, CT, CX, D2, D4, DL, DU, EA, EI, ES, F, G, H4, HA, HB9, HBØ, HC, HH, HI, HK, HL, HP, HR, HS, I, J5, J6, JA, K, KH2, KL7, KP4, LA, LU, LX, LY, OA, OD, OE, OH, OK, OM, ON, OZ, P2, PA, PY, S2, S5, S7, S9, SM, SP, T7, T9, TA, TF, TG, TI, TJ, TL, TN, TR, TT, TU, TY, TZ, V3, VE, VK, VU, XE, XT, YL, YN, YO, YS, YV, Z2, ZA, ZL, ZP, 3C, 3D2, 3DA, 3V, 3X, 4S, 4U1UN, 5H, 5N, 5R, 5V, 5X, 5Z, 6W, 6Y, 7P, 7Q, 9A, 9G, 9J, 9Q, 9U, 9V, 9X, 9Y.

Worked Slovenian Prefixes Award. This award should be pretty easy, considering all of the big S5 signals coming out of Slovenia during just about every DX contest. Look for the DIG (Diploma Interest Group) logo on valid cards. Thanks to Bill Morgan, KØDE, for the sample.

The award is issued by the Slovenian section of DIG for contacting/hearing its members. Contact different Slovenian prefixes on or after 24 October 1992. It is available in three classes: Class A requires all ten prefixes (S50–S59), Class B seven prefixes, Class C four prefixes. All bands and modes may be used. Endorsements for single band or mode upon request. The fee for each award is $US7, 10 IRC, or DM10. Apply to: Tomaz Gortner, S52QM, Na kresu 13, SI-4228 Zelezniki, Slovenia.

Internet Site of the Month

HL1KIS has done a great job of researching awards pages from all over the world. There are plenty of links to follow for many new awards and certificates. Take a look at: <http://www.qsl.net/hl1kis>.

I'm still looking for award samples to fill this column over the next few months. If your club or group sponsors a neat award, I'd like to receive the rules and a sample copy of the certificate.

73, Ted, K1BV

Looking Ahead in CQ

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

- "The Coming Revolution in Amateur Radio—Part II," by WA6ITF
- "*CQ* Reviews: The Alinco DM-330MV Switching Power Supply," by WB2AMU
- "How to Work the International Space Station," by KC4YER
- "A 'Flying Solo' Cable Tester," by KB2YTN

Plus:

- "Low-Impedance, Parallel, Square-Conductor Transmission Lines," by VE3ERP
- "Weathernode Paging," by KC5RTH
- "Merry Christmas, Little Tim," by K8WPI

Do *you* have a ham radio story to tell? See our writers' guidelines on the *CQ* website, <www.cq-amateur-radio.com>.

VHF Plus

BY JOE LYNCH, N6CL

All About The World Above HF

Aurora, More Aurora, and the Perseids

Between the middle of July and the middle of August, VHF-plus operators were treated to two aurorae and the *Perseids* meteor shower. In mid-July the Earth was saturated by an outburst from a proton event caused by an X-class flare. The resultant coronal mass ejection (CME) triggered a severe G5 category geomagnetic storm, which pushed the *K*-index to 9 for approximately nine hours. A sidebar accompanying last month's column gave a preliminary report on July's aurora. Below are additional reports of activities during that aurora.

Then, nearly a month later, VHF-plus operators experienced the effects of this year's third major aurora. In a rare combination, both a major meteor shower and an aurora took place simultaneously. An unexpected aurora occurred during this year's *Perseids* meteor shower when the Earth was once again hit by energy from a solar flare, which took place on 9 August. The resultant flare caused a class G-3 (strong) storm that at times reached G-4 (severe) levels, beginning at around 1930 UTC, 11 August and lasting for approximately ten hours.

The Boulder *K*-index began rising dramatically at about 0600 on 11 August, reaching 5, then hovering around 4–5 for the next 24 hours, when it then rose to 7 for six hours. It declined to 5 for three more hours beginning at 0900 UTC on 12 August, then moving down to 4 for three hours and then to 3 for six hours. It spiked at 6 for three hours beginning at 2100 UTC.

This combined sky show was a once-in-a-lifetime event. Nevertheless, for all the excitement the simultaneous *Perseids*-aurora stimulated, it also was problematic for the VHF-plus operator.

Aurora-*Perseids* Shower Intrigues, Disappoints VHF-Plus Operators

Billed as another shower that would be better observed on the radio than visually because of the nearly full moon, this year's *Perseids* meteor shower proved just the opposite. Thanks to the unexpected auroral display that spilled all the way down to the mid-latitudes, visual observers were treated to a rare sight of a meteor shower and an aurora at the same time.

While the visual display was something to behold, the radio activity was less than spectacular. Shelby Ennis, W8WN, reports that most of the data he received indicated that this year's shower was another less than average to average peak. Furthermore, the aurora propagation actually complicated the efforts of the high-speed meteor-scatter (HSMS) operators who were trying for completions via meteor scatter. Commented Ennis, "I think the aurora wiped out all the activity and may have wiped out the pings too, for a number report hearing very few pings on any of the stations during the aurora. Of course, the antenna headings wouldn't have been optimum, but there still seem to have been few pings during that time."

The most spectacular visible display occurred after moonset in the early morning hours of 12 August. Sightings of the aurora were made as far south as Los Angeles suburbs and Bishop, California, Colorado, Kansas, and Utah. While reports of the aurora began as early as 0145 UTC on 12 August in Colorado, the most spectacular displays took place between 0745 and 0845 UTC, when the *Perseids* was at a plateau during the aurora.

Ennis also observed, "*Early* reports indicate that the *Perseids* meteor shower this year was not exceptional, but *later* reports seem to describe a 'normal' shower for the 'old standard' *Perseids*. Both visual and radio reports tell of a fair number of very long, strong burns. There are reports of a large number of quickly-completed contacts, some using only low power.

"The peak times for this year's *Perseids* were predicted to be about 0500 UTC on 12 August and (main peak) 1000 UTC. Europeans reported a sharp, early peak at about 0530 UTC and a normal, broad peak at about 1000 UTC. The best pings and bursts were noted in central Kentucky between about 1400 and 1530 UTC.

"Was the peak really a little late, or was the aurora to blame for this? Or perhaps there were just a few little filaments giving some extra enhancement at that time? There was *no* random MS activity heard during most of the aurora, as everybody was busy with it. Routine schedules continued, however.

"One noteworthy meteor-scatter contact was made between NJØM in EN34cv and K9KNW in EL95dx for a distance of approximately 1467.7 miles (2362 km). This may be a new North American HSCW DX record on 144 MHz. Another report lists a contact only a few miles shorter; and we now have at least three recent contacts within a few miles of the same length, depending somewhat on the accuracy of the coordinates of each station.

"There apparently were a number of other contacts at longer than average distances. Anything beyond 1400 miles via MS is exceptional, and would have been considered nearly impossible in the past.

"Several 222 MHz contacts were completed this year, often very quickly! We have heard of several 432 MHz schedules on the 13th, but no results are available yet."

As Ennis pointed out, it is most likely that the auroral-induced ionized atmosphere may have been impervious to any further ionization from the meteors' burn-ups. Furthermore, for the HSMS operator who is dependent on a narrow bandwidth, the Doppler shifting occurring during the aurora most likely would have shifted the signal right out of the passband of the HSMS receiver, thereby negating any reception of the transmitted signal.

Furthermore, as Ennis also observed, the point-to-point paths for propagation would have been skewed in relation to the aurora oval, meaning that although propagation was possible, the antennas would have had to be reoriented to take advantage of the propagation. Certainly, this extremely rare phenomena of both a meteor shower and an aurora taking place simultaneously bears more studies to determine what indeed happens to the atmosphere during such competing modes of ionization excitation.

While the HSMS operator trying to work meteor-scatter-induced propagation would have been adversely affected, the SSB operator may not have been as unfortunate. While still contending with the auroral-induced ionization, the SSB operator would have had the advantage of the real-time awareness of the propagation in order to make the adjustments to operations.

Nevertheless, the purist who was trying to work meteor scatter would have had his

VHF Plus Calendar

Sept. 18	144 MHz Fall Sprint
Sept. 26	222 MHz Fall Sprint
Sept. 27	New Moon
Sept. 28-Oct. 1	Microwave Update *(See last month's column for details.)*
Oct. 1	Poor EME conditions
Oct. 4	432 MHz Fall Sprint
Oct. 5	First quarter Moon and lowest declination
Oct. 6	Moon apogee.
Oct. 8	Poor EME conditions
Oct. 13	Full Moon
Oct. 14	Microwave Fall Sprint
Oct. 15	Moderate EME conditions
Oct. 19	Moon Perigee and highest declination
Oct. 20	Last quarter Moon
Oct. 21-22	First weekend of the ARRL EME contest
Oct. 22	Excellent EME conditions
Oct. 27	New Moon
Oct. 29	Poor EME conditions.

EME conditions courtesy W5LUU.

P.O. Box 73, Oklahoma City, OK 73101
(phone 918-627-6625; fax 918-835-9785)
e-mail: <n6cl@cq-amateur-radio.com>

or her efforts totally disrupted by the onslaught of the auroral-induced propagation. Hence, these operators would have been frustrated, rather than thrilled, by their efforts to complete their contacts.

Another contributing factor to the lack of reports was the time of day that the propagation occurred. Typically, the very early morning hours is the slowest time because most operators are sleeping or otherwise not on the radio during that timeframe. Unfortunately, nature being what it is—that is, totally unpredictable—propagation occurs when and where it does and generally not according to any man-made schedule.

As indicated by the lack of reports, many VHF plus operators were caught off guard. Yet several of the diehards were awake and were able to take advantage of the unique propagation. The reports reaching your editor are the following:

Dave Teague, K5MQ, EM31: "On 12 August, W8MIL EM74, MS; K4SSO, EM48, MS; NØDQS, EN22, tropo; NJØM, EN34, tropo; NØPB, EM39, tropo; NØSXW, EM39, tropo; KD5CDU, EM37, tropo; KWØA, EM48, aurora; NØPB, EM48, aurora; KAØPQW, EN33, tropo. There was both meteor scatter and aurora in Louisiana in one night—a once-in-a-lifetime event? This was only the second time I have worked aurora on 2 meters. I also *heard* K4SSO, EM48, and KØSM, EN10, on CW aurora but no QSO. Also heard W6SAO DM79 on SSB aurora (man, that sounded weird!) but no QSO. On 13 August, W7XU, EN13, MS; and NJØM, EN34, MS, a sked (which I completed in three minutes!).

"I only ran three skeds during the *Perseids* peak period between 12 and 13 August. All three were completed. I never really saw a peak in the shower. There is usually a very pronounced peak for randoms on 144.200 MHz for a few hours. It did not happen at all this year. I think the tropo and aurora may have had the propagation messed up for the meteors hitting the *E*-layer."

Ken Neubeck, WB2AMU, wrote the following concerning 6 meter propagation: "There was one opening early on the 11th, around 0400Z, where KB3CWS was able to work into Alaska, apparently by auroral-*E*. (539 report given)

"The next night, I started listening all night. At about 11:30 PM (0330 UTC, I heard K3KYH (FN24) calling CQ and working stations. He was the only one that I could hear at about 44A signal strength. I went to bed and woke up at 4:45 AM (0845 UTC). I heard several aurora signals on the band and I worked K1TOL (FN53), WA3WUL (FM29), and K2MUB (FN20) on CW using 10 watts and a dipole. The stations told me that VE8 and OX stations were being heard at that time (0800–0900 UTC)."

Pierre, VE2PIJ, FN35: "The following is my log during the aurora of 12 August. Except for AF1T, all QSOs were on 2 meters. AF1T was on 6 meters: AF1T, FN43; WAIT, FN43; W1NRB, FN31; VE2ZP, FN25; N2ODU, FN02; K1SG, FN42; W3EP, FN31; N2WVK, FN13; K2AVA, FM19; W3TC, FN00; AA1TT, FN33; N3WVB, EN90; KB3CWS, FN10; K3KYR, FN23; WA8DXB, EN91; K2YSY, FN20; KB2DYB, FN22; AA6YQ, FN42; N3FA, FN21; VE3LBZ, FN03; WØVHF, FN12; WA3WUL, FM29; KC1MA, FN51; W1PM, FN41; KA9CFD, EN40; VE3SQZ, FN04; N1GE, FN41; and KC8MZB, EM89."

Mid-July Aurora Report

What occurs perhaps four times a solar cycle at best occurred last July—a geomagnetic storm with a *K*-index of 9, sustained for many hours. Last month I listed a few reports of the mid-July aurora in a sidebar. During the ensuing month, I received more reports:

Szigy, YO2IS: "Was pleased to listen again to nice auroral signals on VHF, on both 2 and 6 meters. In my area was no QRM! Unlike west of Europe, YO2II and YO2LEA both QRV in the event are far away in the next field (KN06).

"Here is my report: On 2 meters, 15 July 2000, G3LTF, IO91gg, 1775 km; DK1CO, JO63sx, 1067 km; DL9MS, JO54wc 1154 km; DK1KO, JO53ct, 1195; OZ1FDH. JO65cs, 1281 km; G4SWX, JO02pb, 1614 km; CWNR: SP4MPB, DL8CMM, PA3FOC, DJ7RI, DK6XY, DL8LAQ, and OZ8ZS. Rig HM TVRT 28/144 MHz & 4CX250B & 10-el at 12 meters. On 6 meters, 16 July 2000, OZ8ABE, JO55vf, 1246 km; OZ1DJJ, JO65HP, 1255 km. Rig HM TVRT 28/50 MHz & QB3/300 & 5-el at 10 meters.

"Pity that was not on for the midday iono condx up to Scandinavia. No signals heard on 70 cm band; this event was less intense than the big one from 13 March 1989."

Dave, NØIT: "During the July 15 aurora I worked 28 stations in 23 grids on 2 meters using 170 watts to an M2 Eggbeater up 15 feet. Best DX from my EM48 QTH was KØGU (800 miles). Also heard stations out east (K1SIX, K1TEO, W3EME, K1UHF) but they didn't hear me in the QRM or because I couldn't figure out the Doppler. Details are shown below:

"WØVD, EM27; K4QI, FM06; K5CM, EM26; WAØWPJ, EM29; KØKD, EN31; K5ACR, EM04; W4WTA, EM83; KØETC, EM27; K5JL, EM15; N5KDA, EM41; W9FX, EM57; AG4V, EM55; KA9CFD, EN40; W4HP, EM75; K5MQ, EM31; WB4WXE, EM74; AD4OK, EM77; NEØP, EN41; KØGU, DN70; K9AKS, EN41; W8JKS, EM89; K4EA, EM74; NØLL, EM09; WAØKBZ, EM48; W5HUQ, EM35; N4UK, EM84; K5SW, EM25; and W8WN, EM77.

"During much of the opening, the signals were *loud* (20–40 dB over S9). At my latitude, I don't hear auroral signals that strong. Usually more like S3. Many of the stronger signals seem to be from the south of me. Not sure if that was propagation or because I was working guys putting out some real ERP."

Maarten, W1FIG: "Following a summary list of best DX worked. Total of 31 aurora QSOs. Best DX +AD4—1000 km. The highlights include: W9FX, EM57, 1570 km; W9VC, EM79, 1166 km; K2DRH, EN41, 1615 km; N4UC, EM66, 1460 km; KØVSV, EN41, 1650 km; W8BYA, EN70, 1138 km; KØMQS, EN31, 1780 km. Best DX during opening. Also worked: KA9CFD, EN40, 1634 km; KK4CA, EM75, 1366 km; and K8DEO, EM89, 1003 km. On 16 July worked WA4MVI, EM84, 1294 km, in South Carolina, most southern station."

Steven Kerns, N3FTI: "I saw the post on the VHF reflector on Friday morning that a storm had been detected, and it would arrive some time Saturday afternoon. Because I don't have antennas up at my home (I operate 50 MHz to 3.4 GHz from a mountaintop location during contests!), I assembled my portable 6 meter 5-element and 9-element 2 meter Yagi and put them up on a portable mast 12 ft. above the ground.

"I was scheduled to work a half day on Saturday but was home and on the air by 1900 GMT. In a 3-hour period I worked 21 stations in 13 grids on 6 meters with 100 watts. Although I heard many stations on 2 meters, I only called a couple and was unable to make contact. I think there were enough higher power stations on that my 50 watt signal did not attract a lot of attention."

Tim, G4LOH: "For your information, I worked 158 QSOs including 10 via ionoscatter to KP03, KP15 and JP92, JP93. Contacts ranged between 1200 and 2000 km in 19 countries outside of the UK. Most northerly via Au was KO29, southerly JN63, most DX contacts to the southeast YU/HA/9A/OM on QTF 085 degrees. Many stations very strong, the end of a CQ call being followed by a 30 dB noise lift! Impossible to pick out callsigns or even a single letter much of the time, the result being that I may have missed contacts greater than 2000 km because of the extreme QRM; stations 1800/1900 km away were often 59+."

Leif, SM5BSZ: "On Saturday and Monday we have had most unusual iono scatter conditions here in Europe. Currently I have only a small antenna (a single 2SA13X) and I can not rotate it. It is sitting 2 meters above ground on a primitive isolated arrangement and I can carry it around to make it point in different directions. (The feeders preamps are on the ground and not easily moved.)

"I did not work much via the very good aurora; it is not so easy when one cannot listen while turning the antenna. It is not so fun either. I am used to use radar (QSK with PIN-diode switch) to find where to point the antenna in azimuth and elevation so I felt kind of blind for the aurora. (It was also raining heavily outside.)

"This is my 144 MHz log from JO89ij (times in UT): July 15—G7RAU, IO90; PA3DYS, JO31; G4YTL, IO92; G4SWX, JO02; PA3BIY, JO22; F6IFR, JN09; DJ9CZ, JO31; PA5DD, JO22; PA4VHF, JO32 (BIG pileup all the time); G4LOH, IO94; G3MLO, JO01; DL9YCY, JO41; PA9KT, JO33; DJ5BV 439 549 JO30; ON4YZ, JO20; DL9YEY, JO41; DL4NAA; DL1EJA, JO31; DJ9EV, JN49; DK8VS, JN39; DF1CF, JN57; DL8GP, JN39; DL3RBH, JN58; DK3FW, JO42; HB9DFG, JN37; DF1IAG; DL5ROB, JN67; 9A2AE, JN86; DK1KO, JO53 (on back lobe); DK1YY, JO63; DK5LA, JO44; DG9NCX, JN59 (Big IONO event over for this time so QRT); OH6XX, KP22; RU1AA, KP40; LY2CI/A, KO15; RA1ZC, (aurora E, PMSE

or iono); OH5WR, KP41; SP8UFT, KO11; RW3PF, KO93 (aurora E, PMSE, or iono?)

"Heard the T9 component together with the aurora signal so turned antenna for direct heading. Then there was only the T9 signal present.

"Later I worked ES1DW, KO29; LY2AT, KO14; July 16: OM5LD/P, KN09 (my first ever OM via aurora); UA3MBJ, KO88; SP2BOF, JO94; UY5UG, KO50; LY3OD, KO24; SP2CNW, JO93; iono test with PAØJMV at noon was negative. I think iono is always poor the day after a major aurora. On July 17: DG9NCX, JN59 (really strong!); F5LRL, JN26; DK8VS, JN39 (The extreme IONO conditions continued for hours. Work day, so poor activity. DG9NCX was easy copy via SSB in the afternoon.)

John, W5UWB: "One aurora opening this far south (EL17ax) per solar cycle is about par. Now I have had two this year (April 7 and July 15)! Beam heading for best signals was 35 degrees. Needless to say the opening was quite short. I worked the following on 144 MHz: W7FG, EM26; K4QI, FM06 (best DX this time); W5HUQ, EM35; and K5JL, EM15. And that was the end of it!"

Dave, G4RGK (IO91ON): "I worked on 432 MHz on aurora the following: DK8VS, JN39nf; 9A2SB, JN95gm, 1571 km; and OE3JPC, JN87ew, 1298 km. QTF for all contacts was 70 degrees, 15 degrees elevation. I only had propagation for about 20 minutes on 432. There was a visual aurora overhead at the time."

Carlos, N4IS: "I have just few words on this subject but I would like to tell you that for the first time I heard aurora CW signal in EL96 Ft Lauderdale, FL. I have a temporary antenna at 20 ft., 12-el. I was impressed being able to hear those signals. Unfortunately no QSO but I heard guys in EL97 who worked aurora."

John, NEØP: "It has been a great few days here for 2 meters. It all started on Thursday night with tropo. Among the contacts are the following: July 14: W9FX, EM57; NØBQV, EM37; K9IMX EM37 (almost made it on 432); K5SW, EM25; KB5HMZ, EM15; KBØCJ, EM48 (also completed on 6 meters for new grid); and K5CM, EM25.

"On Friday morning the tropo was still there! I worked KM5ES, EM25. Saturday I walked in the shack around 2110 after getting back from St. Louis and found the aurora in full swing. All of the following were via the aurora on 2 meters: W5HUQ, EM35; K5JL, EM15; W9FX, EM57; 2121, W8WN, EM77 (a new state on 2 meters!); NØIT, WA9HCZ, EN43; K5CM, EM25; W4HP, EM75; K8KD, EN82; WØDB, EN11; KØETC, EM27; NØLL EM09; N9TF, EN52; KAØGGI, EM48; K5SW, EM25; W7FG, EM26; WAØKBZ, EM48; WA9JML, EN51; W3EME, FM19; WA2FGK, FN21; and K3CFY, FN00.

"After getting home again Saturday night I first worked NØPB from EM39 on tropo, and then he started to take on an aurora sound, and caught two more on aurora: K8TQK, EM89; and K5CM EM25.

"I did try a few 432 auroras with no success. Heard no one on 6 meters, as can be understood with the strength of the 2 meter

aurora. I do try on 6 meters during every opening just to try to get a few close-in grids; a new grid on 6 meters is about as good as a new grid on 2.

"In all, I worked three new states on 2 meters: OK (first on tropo), KY, and PA. Also worked ten new grids on 2 meters. It was quite a few days; hope it didn't spoil me too much."

Brad, W9FX, EM57nx: "My activities began at 2022 UTC when I walked into the shack and found the 2 meter band literally full of CW aurora signals. From my location in EM57nx, I worked a total of 71 stations in 50 grids during the period 2022–0129 UTC. I had to leave the rig from 2329 through 0115 UTC and undoubtedly missed some additional contacts during that period.

"Upon my return from family commitments, I was pleased to find and work W7SAO in DM59—the only signal I heard anywhere on the band. We exchanged mutual 55A reports. Following that contact, no more signals were heard. Notes:

"1. First time I've ever had to use 'QRL?' on 2 meter CW before calling CQ.

"2. First time I've ever had to use a narrow CW filter to sort out the many stations calling during an aurora event.

"3. Signals peaked at 40 degrees AZ during the first hour's operation; later the curtain provided best reflections from between 350 and 0 degrees AZ.

"4. My QSO rate at one point exceeded 100 per hour—another first for 2 meter operation at this station. Resorted to contest style operations.

"5. Kudos to the entire VHF community for taking advantage of the frequency spectrum and spreading out across the band. Heard and worked stations from 144.125 through 144.250 MHz. Very refreshing!

"6. First time in my 23 years of 2 meter experience I've ever seen aurora signals pump my receiver's S-meter to S9-plus levels!

"Here's the complete grid list for the event (all stations worked on 144 MHz): DM59, DM98, DN70, EM04, EM09, EM12, EM20, EM22, EM25, EM26, EM27, EM48, EM50, EM52, EM70, EM73, EM77, EM79, EM84, EM86, EM95, EM96, EM98, EM99, EN10, EN20, EN32, EN34, EN41, EN44, EN52, EN61, EN74, EN82, EN90, FM07, FM08, FM09, FM16, FM18, FM19, FN00, FN21, FN30, FN31, FN41, FN42, and FN43."

Shelby Ennis, W8WN: "Strong radio aurora today, 2000 July 15 in EM77bq, central Kentucky. First signals observed just after 2000 UTC. Later, at 0100 UTC, July 16, signals were fewer and weaker.

"This was a southern aurora. Only one station near the US/Canadian border heard so far (in FN14, southern Ont.). Few north of New Jersey and Connecticut heard. Across southern Michigan to southern South Dakota (EN13). West to Colorado (DN70 & DM78), south to southeast Oklahoma, south to mid-AL (EM62!), east to NC/SC border (FM04).

"Most stations were contacted with beam to NW and as far around as 300 degrees AZ. Most East Coast stations worked with beam in this direction. Often peaked very well there, and was primarily looking for stations in that area. But often stations on East Coast were much better at that heading than with beam to northeast. Often experienced a null to the north. Tried elevating beams but that was no good. Above about 15-degrees elevation, signals would drop some. Best elevation was 8–10 degrees.

"Aurora log of W8WN: Note—Nearly all contacts made with antennas to northwest, often as far around as 300 degrees AZ, even for the East Coast and SE stations. K3KEL, FN11; W9VC, EM79; N4TJ, FM04; W4WTA, EM83; K5JL, EM15; K1SIX, FN43; W3ANX, FN00; K4EA, EM74; K2PQI, FM09; W5HUQ, EM35; WØVD, EM27; K5MQ, EM31; NØLL, EM09; K5CM, EM25; NEØP, EN41; WB4WXE, EM74; W3EP, FN31; K4TO/M, EM77; K4SSO, EM48; K3XT, FN20; KØGU, DN70; W4MYA, FM07; W9FX, EM57; NØTF, EN52; WØOHU, EN34; W3EME, FM19; KDØPY, EN41; W8HOM, EN71; KØSM, EN10; K2SMN, FN20; W3IP, FM19; W7XU, EN13; K9AKS, EN41; KØCQ, EN32; N4UK, EM84; and KAØGGI EM48.

"On July 16: K8RYU, EM99; VE3IEY, FN14; AG4V, EM55; AD4TJ, FM08; WØAH, DM78; KØKD EN31; W3EKT FM19; 0030 W4LK EM93; 0039 WA9TKE EN61; 0041 KB0CJ, EM48; WA8CLT, EN80; WA4HFN, EM55; K2PQI, FM09; NØOFA, EM86; NØIT, EM48; K4QI, FM06; N3FL, FM19; K9SB, EN52; and KØMQS, EN31. There were many others heard, not worked, including someone in EM62."

Contests & Conferences

2000 VHF/UHF Fall Sprints. The contest periods are as follows.

144 MHz Sprint: 7–11 PM local time, Monday, September 18.

222 MHz Sprint: 7–11 PM local time, Tuesday, September 26.

432 MHz Sprint: 7–11 PM local time, Wednesday, October 4.

Microwave (902 MHz and above) Sprint: 6 AM to 1 PM local time, Saturday, October 14.

50 MHz Sprint: 1200–1900Z, Saturday, October 21.

For further details see the *CQ* web page: <www.cq-amateur-radio.com>. Results will be posted on the VHF reflector and <www.svhfs.org>.

ARRL EME Contest: This year's ARRL EME Contest will be on October 21–22. Conditions are forecast to be excellent. Complete rules were in last month's *QST* and are posted on the ARRL web at: <http://www.arrl.org/contests/announcements/rules-eme.html>.

2000 North American HSMS Contest. Results of this contest are in and may be viewed from the third link on KØXP's two web pages: <http://www.qsl.net/k0xp> or <http://www.net1plus.com/users/ko0u>.

The **2000 Microwave Update** conference is scheduled for 28 September to 1 October in Philadelphia. See last month for details.

Current Meteor Showers

The *Orionids* is predicted to peak around 21 October. The exact time was not available

at press time. Check with the International Meteor Organization's web page for up to date information at: <http://www.imo.net>. A characteristic of this shower is that it has several smaller peaks both before and after the main spike. The second major peak is expected approximately four days after the main peak. At peak the zenith hourly rate (ZHR, the number of predicted meteors falling per hour) is predicted to be around 20. Look for activity associated with this shower for approximately 16 days beginning a week before the main peak.

Hans Peters, VE3CRU, SK

The following is from Peter Shelton, VA3AX: "Hans Peters, VE3CRU, passed away Saturday, 22 July, after a long but courageous battle with cancer. Hans was an avid EMEer, and stood at 48 states worked on 432 MHz. He was also a key figure in the VE3ONT Algonquin EME expeditions in 1992–95 and graciously provided the 432 MHz equipment for that adventure. He was the first person to make a QSO from the big dish.

"More notably, Hans is remembered for his contribution to the 220 MHz ops in North America. After establishing a Microwave Modules distributorship in Toronto in the late '70s, Hans recognized the need for a 220 MHz transverter similar to the MMt 144-28 and MMt 432-28 which were so popular at the time. Microwave Modules was reluctant to provide transverters for a band that was not available in England so Hans started modifying the 144-28's to 220 MHz and selling them. After some time he was finally able to convince MM to provide bare boards for the 220 MHz program—it was easier than converting them!

"I understand there are several hundred of Hans's 220 MHz "MMt 220-28's" out there. I only sold mine last year after upgrading. It served me well and I hope there will be many others in service for years to come. I ask you to remember the fellow who made it so easy for us to get on that band.

"Good VHF DXing Hans!"

And Finally . . .

This has been a full month of reports. Most intriguing was the coincidental aurora-*Perseids* meteor shower phenomena. We who work the VHF-plus frequencies never know what to expect from them. Therefore, it pays to keep alert via whatever means available in order to take advantage of such unique openings.

Certainly, the auroras this year, especially July's, will be talked about for years to come at hamfests and conferences. Those of us who were able to participate will endlessly recite the lists of QSOs we made. And when we see one another, we will congratulate each other over and over for that special contact we exchanged.

That's what it is all about. We are family. As family, we enjoy each other and look forward to seeing each other at the different conferences and hamfests. And as family, we need to keep on expanding our family ties by including and encouraging the younger members to become involved. At the Central States VHF Society conference this past July there was a concerted effort to add younger members to the board of directors of that organization. They found, just like all of us, that the pool of available candidates is pretty shallow. This is our challenge: to continue to recruit new and younger hams into our fascinating world of the VHF-plus weak-signal bands.

My thanks go to Lloyd Ellsworth, NE8I, who very kindly sent me two videotapes of the events at the Central States VHF Society conference. It made me feel as if I had been there with all of the rest of the participants. Hopefully next year I can be in Dallas at the 2001 CSVHF Society Conference.

Speaking of thanks, I thank you all for your contributions to make this, your column, a continuing success. Please continue to e-mail your reports to me. Until next month...

73, Joe, N6CL

Contesting

BY JOHN DORR, K1AR

News/Views Of On-The-Air Competition

Is There A Connection Between Contesting and Sunspots?

October's Contest Tip of the Month

When you're compiling your multiplier list while operating (if you're not already calling them), usually from a combination of searching and pouncing and packet radio spots (if single op assisted/multi-op), think about how you use your rotator. Try working as many stations as possible in the same direction rather than turning (and waiting) the beam for every QSO. You'll improve your efficiency and maybe make your rotator last a few more contests.

Also, don't be afraid to call a multiplier with the beam in the wrong direction. Often a station doesn't have that many guys calling, and being "loud" is not critical to making the QSO. Your rotator will thank you later, and your score will fare better—I guarantee!

Calendar of Events

Sept. 23	Panama Radio Club Contest
Sept. 23-24	**CQ/RJ WW RTTY Contest**
Sept. 23-24	Scandinavian Activity SSB Contest
Sept. 30	Louisiana QSO Party
Sep. 30-Oct. 1	Texas QSO Party
Oct. 7-8	California QSO Party
Oct. 7-8	Oceania SSB DX Contest
Oct. 14-15	Pennsylvania QSO Party
Oct. 14-15	Oceania CW DX Contest
Oct. 21-22	JARTS WW RTTY Contest
Oct. 21-22	Worked All Germany Contest
Oct. 22-23	Illinois QSO Party
Oct. 28-29	**CQ WW DX SSB Contest**
Nov. 4-6	ARRL CW Sweepstakes
Nov. 10-12	Japan Int'l SSB DX Contest
Nov. 11-12	Worked All Europe RTTY Contest
Nov. 11-12	OK/OM DX Contest
Nov. 18-19	LZ DX Contest
Nov. 18-20	ARRL SSB Sweepstakes
Nov. 25-26	**CQ WW DX CW Contest**

Did you operate in this year's Worked All Europe CW Contest during the dog days of mid-August? If you did, you probably were asking yourself, "What happened to the peak of the sunspot cycle?" Conditions during that particular weekend displayed some of the worst propagation I had ever seen—even during the bottom of the solar cycles I've experienced as a ham of 30 years. Naturally, when the *A*-index, as reported by WWV, is in excess of 65 and the *K*-index is coming off a high of 7, you can't expect too much. However, it seems that there should be some right of passage associated with a solar high.

Like you, I'm hearing from more and more active hams that this current solar peak has been a bust. While that may be a bit of an overstatement, it does seem that band conditions have not risen to the level that I remember from previous solar highs. For example, I remember the days when 10 meters was open every day without fail. The band stayed open well into the evening, often yielding QSOs after midnight into far-reaching locations around the globe. That simply has not happened this time.

The question I'm asking you to consider this month is whether or not this solar phenomenon has impacted contesting. After all, it would seem that propagation and contesting go "hand in glove." When the bands are hot, so is a contest, or so it seems. The good news is that very few contests experience the propagation we encountered during the WAE weekend. While there were significant periods of time when QSO rates were unusually low, the contest still carried on, and by the end of the weekend 20 meters began to return to its old self.

My view of the world on this subject is that propagation does not have a lasting impact on the popularity of contesting. There are plenty of numeric metrics on the subject. However, in general terms, contest activity is at an all-time high. Both the CQ WW and ARRL DX contests are experiencing record log submissions. Not only are the log counts high, but so is the continuing proliferation of records and high QSO totals. The current level of activity is simply extraordinary—hardly an indictment against the lackluster performance of this sunspot cycle.

In my opinion, contest conditions can be very good or unbelievably bad, simply varying by the weekend. Take, for example, the 1995 CQ WW DX SSB Contest. Here is my soapbox comment from that amazing weekend:

"Like most people, I had fairly low expectations for the '95 contest. Without too much analysis one can conclude that solar minimums usually result in boring DX contest weekends. Was that the case this year? No!! It actually makes me wonder sometimes if the fantastic band conditions we experience during most CQ WW contests are created by the huge quantities of RF leaving the Earth during those very special 48 hours."

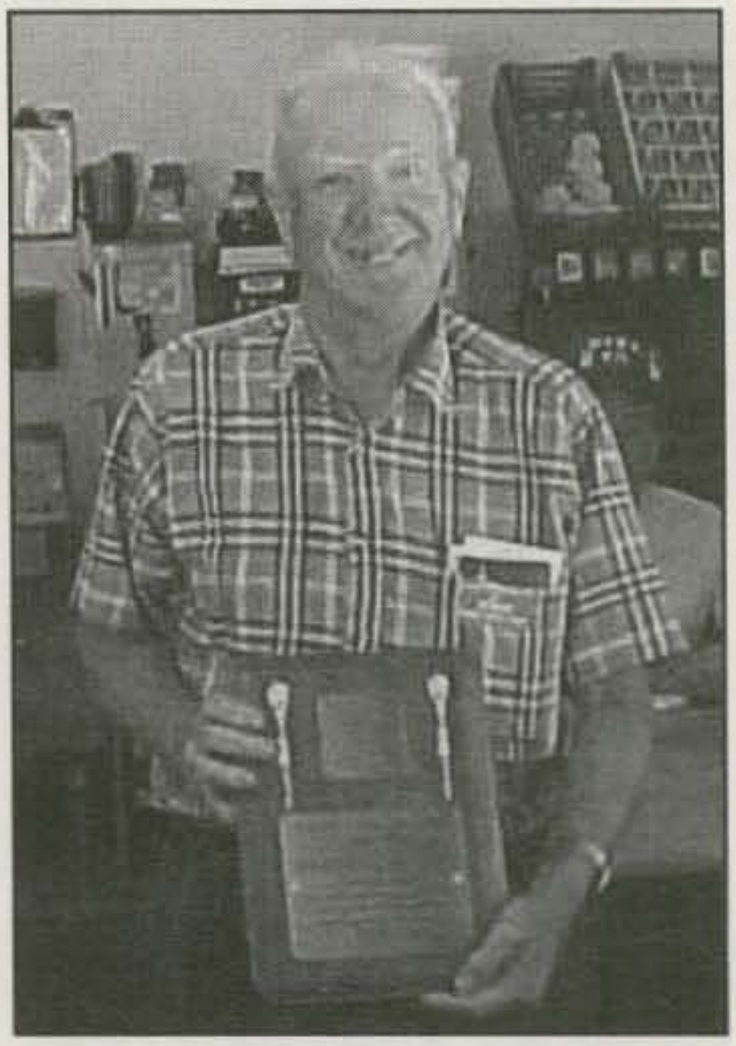
Yes, even during the bottom of the sunspot cycle contests can be great. With 3600 QSOs during that weekend of five years ago, I'm sure you'd agree.

With all the talk from supposedly knowledgeable pundits that ham radio in general and contesting in particular are winding down to their inevitable death, I submit that their staying power is as high as ever. In the 30-plus years that I've been contesting, propagation has rarely produced disastrous results. There's something magical about the anticipation of a pending contest that brings everyone out to operate—regardless of conditions. As a group, we always manage to make the best of any propagational challenge, which is one of the great strengths of contesting.

Thus, while we may not be setting solar records in this particular cycle, I can assure you that this fall's operating events will continue to set records. This contest season will produce even more fun and operating challenges for everyone. That's the reason we all operate contests in the first place, isn't it?

Final Comments

Beginning this month, we are moving the announcements of contests around the



Ed Bissell, W3AU, is shown here with his Contest Hall of Fame plaque, which was presented to him by Dan Street, K1TO, at the June meeting of the Florida Contest Group. Ed is an honorary member of the FCG. (Photo via K4LQ)

2 Mitchell Pond Road, Windham, NH 03087
e-mail: <K1AR@contesting.com>

1999 CQ WW DX SSB Results Additions

The following scores were inadvertently left out of last month's results.

		ASSISTED			
		UNITED STATES			
WA4IMC	A	1,651,286	1455	107	315
NY6DX/2	"	1,318,683	1128	111	342
KX1X	"	1,235,836	1103	95	309
NM1W	"	1,068,552	898	105	354
N7RO	"	979,956	1104	89	245
NY5B	"	875,160	1010	104	304
K2SX	"	579,240	618	81	279
K1TW	"	521,664	587	71	241
K1TS	"	387,940	592	49	189
NC1N	"	270,402	405	57	184
W1SBD	"	265,811	326	67	232
KI6Y	"	197,825	362	69	136
WØZA	"	126,616	296	48	104
KA1DZV	"	117,740	262	55	148
NT1R	"	18,018	94	27	64
KØOBX	"	2,211	29	14	19
		CANADA			
VA3DX	A	2,125,020	1539	131	404
VE4COZ	"	651,472	970	76	228
		ASIA			
		JAPAN			
JHØSGG	A	38,160	131	35	71
JG2TKH	28	247,752	619	36	112
		EUROPE			
		BELGIUM			
ON7NQ	28	325,800	613	39	161
		CROATIA			
9A3RE	28	205,025	694	32	107
		EUROPEAN RUSSIA			
RK3BY	A	526,526	1248	58	205
		GERMANY			
DL5AUA	A	149,800	298	57	118
DJ6TK	"	106,454	247	55	147
DL2ZAV	"	47,596	177	46	100
DK8NX	28	8,757	55	20	43
DH5HV	14	161,454	727	33	109
		ITALY			
IK4DSP	A	114,723	291	52	137
IK3UNA	28	522,792	1447	37	122
		POLAND			
SP4TKR	21	388,314	1274	35	127
		SARDINIA			
ISØNHT	28	454,608	1095	37	131
		SWEDEN			
SM7BHM	A	399,168	769	76	260
SM3D	28	67,320	464	23	76
				(Op: SM3WMU)	
		SPAIN			
EA5FWW	A	409,262	585	74	213
EC5AAI	"	17,072	106	29	59
		YUGOSLAVIA			
YU7AL	28	630,888	1435	38	156
				(Op: 4N7RGH)	
YU1RA	1.8	12,152	220	6	50
		OCEANIA			
		GUAM			
KH2D	A	180,992	274	81	175
		SOUTH AMERICA			
		ARGENTINA			
LU7HVN	28	527,750	1572	28	97
		BRAZIL			
PY2KPY	28	144,875	600	32	93
PU2VYT	"	2,268	45	11	17

world to *CQ*'s web site rather than printing them here. That will leave us more room for other timely topics of interest to the contesting community. Look for the rules at <www.cq-amateur-radio.com>. Continue to send your contest calendar submissions to me so that I can forward them to the *CQ* web site.

I literally have been overwhelmed with the responses you are providing to this year's *CQ* Contest Survey. The vast majority of input received to date has been via the web. It sure beats pen and paper (and postage!), right? I hope to have the results in the next issue or two of *CQ*.

The CQ WW contest season is upon us once again. Don't miss out on some of the finest operating available this fall.

73, John, K1AR

CQ World-Wide DX Contest All-Time Phone Records

BY FREDERICK CAPOSSELA, K6SSS

Number groups after calls are: year of operation, total score, contacts, zones and countries. All-band and Multi-Operator records include a band-by-band breakdown of the world leader in each category.

Single Operator/Single Band

WORLD RECORD HOLDERS

1.8	IG9/IV3TAN('96)	441,252	1,203	24	102
3.5	IG9T('95) (Opr. IV3TAN)	816,959	1,938	33	110
7.0	IG9GSF('97) (Opr. IT9GSF)	1,249,236	2517	35	137
14	PYØFM('94) (Opr. PY5CC)	3,202,242	5,109	38	175
21	ZD8Z('94) (Opr. N6TJ)	3,481,925	5,535	36	179
28	ZD8Z('99) (Opr. N6TJ)	3,794,280	6,247	40	170

AFRICA

1.8	IG9/IV3TAN('96)	441,252	1203	24	102
3.5	IG9T('95) (Opr. IV3TAN)	816,959	1,938	33	110
7.0	IG9GSF('97) (Opr. IT9GSF)	1,249,236	2,517	35	137
14	ZD8Z('95) (Opr. N6TJ)	2,356,065	3,925	38	167
21	ZD8Z('94) (Opr. N6TJ)	3,481,925	5,535	36	179
28	ZD8Z('99) (Opr. N6TJ)	3,794,280	6,247	40	170

ASIA

1.8	UG7GWO('87)	255,852	1,327	12	57
3.5	E44DX('99) (Opr. OH1RY)	261,590	1,017	20	81
7.0	H21A('92) (Opr. 4N4OO)	736,422	1,812	32	107
14	5B4AGC('97)	2,140,790	3,944	35	159
21	5B4AGC('98)	1,551,539	3,095	35	152
28	A61AJ('99) (Opr. DL2CC)	2,177,156	3,974	40	162

EUROPE

1.8	LZ2CJ('84)	107,818	1,319	13	61
3.5	HA8IE('90)	361,343	1,455	35	116
7.0	S59UN('92)	875,875	2,419	37	138
14	OE6Z('99) (Opr. OE6MBG)	1,878,569	4,150	40	177
21	4O6A('97) (Opr. YT6A)	1,980,046	3,280	37	145
28	9A9A('99)	2,272,950	4,071	40	185

NORTH AMERICA

1.8	VE1BY('98)	148,798	806	21	76
3.5	TI1C('92) (Opr. TI2CF)	498,037	1,695	31	108
7.0	TI1C('94) (Opr. TI2CF)	1,108,140	2,882	31	134
14	KP2A('94) (Opr. KW8N)	2,255,250	4,810	38	156
21	KP2A('99) (Opr. KW8N)	2,324,283	5,230	37	146
28	VP2ET('88) (Opr. K5RX)	2,423,880	5,137	37	143

OCEANIA

1.8	KH6CC('85)	45,984	484	13	19
3.5	T32AF('85)	222,768	1,064	23	49
7.0	9M8R('95) (Opr.W7EJ)	1,091,835	2,354	37	122
14	9M8R('97) (Opr. W7EJ)	1,339,743	2,650	36	147
21	9M8R('98) (Opr. W7EJ)	1,944,800	3,471	38	162
28	KD7P/NH2('88)	2,309,304	4,885	38	123

SOUTH AMERICA

1.8	P49I('95) (Opr. K4PI)	58,653	353	14	43
3.5	P4ØR('87) (Opr. K4UEE)	552,786	1,628	23	91
7.0	PJ9U('93) (Opr. OH1VR)	1,199,968	2,637	34	120
14	PYØFM('94) (Opr. PY5CC)	3,202,242	5,109	38	175
21	ZX5J('97) (Opr. PP5JR)	3,181,696	5,264	37	175
28	ZX5J('98) (Opr. PP5JR)	3,322,230	5,392	39	183

Single Operator/All Band

AF	EA8BH('99) (Opr. N5TJ)	25,646,796	10,253	176	692
AS	C4A('98) (Opr. 5B4ADA)	9,781,930	5,105	146	548
EU	GIØKOW('99)	10,457,664	6,375	155	589
NA	KP2A('93) (Opr. CT1BOH)	13,202,298	8,691	148	506
O	YJ1A('90) (Opr. OH1RY)	9,516,731	6,429	160	381
SA	HC8A('99) (Opr. N6KT)	18,607,050	8,638	175	595
QRP	PJ2FR('87) (Opr. K7SS)	3,171,166	3,212	100	234
Low Pwr.	TI1C('97) (Opr. TI2CF)	7,379,253	5,453	144	465
Asst.	P4ØW('94) (Opr. W2GD)	11,224,877	6,323	131	470

WORLD RECORD

Station	Band	QSOs	Zones	Countries
	1.8	150	13	54
EA8BH	3.5	547	18	80
(Opr. N5TJ)	7.0	682	27	97
(1999)	14.0	2,655	39	158
25,646,796	21.0	2,071	39	148
	28.0	4,148	40	155
	Total	10,253	176	692

Multi-Operator/Single Xmtr.

AF	C56T('98)	19,118,437	8,602	162	631
AS	P3A('99)	17,321,994	7,913	164	675
EU	IQ4A('90)	17,255,700	7,253	183	717
NA	VP2EC('92)	16,287,152	7,434	183	685
O	KH2S('91)	11,095,392	7,086	145	387
SA	PJ1B('93)	22,596,570	9,386	164	646

WORLD RECORD

Station	Band	QSOs	Zones	Countries
	1.8	111	10	24
PJ1B	3.5	937	25	94
(1993)	7.0	1,055	29	114
22,596,570	14.0	2,011	38	147
	21.0	1,829	32	139
	28.0	3,443	30	128
	Total	9,386	164	646

Multi-Operator/Multi-Xmtr.

AF	CN8WW('99)	73,194,876	22,960	198	900
AS	P3A('98)	29,108,800	13,073	182	738
EU	LX7A('89)	26,578,978	14,947	175	751
NA	VP2KC('79)	37,770,012	17,767	175	677
O	KHØAM('90)	35,730,600	16,309	179	565
SA	PJ4B('99)	59,127,810	20,618	188	834

WORLD RECORD

Station	Band	QSOs	Zones	Countries
	1.8	1,034	18	83
CN8WW	3.5	2,219	25	118
(1999)	7.0	2,717	35	141
73,194,876	14.0	5,900	40	186
	21.0	4,978	40	181
	28.0	6,112	40	191
	Total	22,960	198	900

CQ World-Wide DX Contest All-Time CW Records

BY FREDERICK CAPOSSELA, K6SSS

Single Operator/Single Band

WORLD RECORD HOLDERS

1.8	C4A('99) (Opr. 9A3A)	261,489	969	21	80
3.5	EA8EA('96) (Opr. OH2KI)	1,175,550	2,672	36	114
7.0	YV5A('95) (Opr. OHØXX)	1,364,465	3,095	35	122
14	P4ØV('91) (Opr. N7NG)	1,883,700	3,521	38	142
21	ZD8Z('97) (Opr. N6TJ)	2,357,967	4,589	39	140
28	ZX5J('99) (Opr. N6TJ)	2,131,942	3,962	39	152

AFRICA

1.8	CT3/OH1MA('97)	144,760	542	20	74
3.5	EA8EA('96) (Opr. OH2KI)	1,175,550	2,672	36	114
7.0	IG9/AC6WE('96) (Opr. UA3DPX)	1,234,317	2,677	37	122
14	CT3BX('97) (Opr.OH1EH)	1,461,397	3,164	37	124
21	ZD8Z('97) (Opr. N6TJ)	2,357,967	4,589	39	140
28	ZS6EZ('99)	2,102,496	4,149	39	137

ASIA

1.8	C4A('99) (Opr. 9A3A)	261,489	969	21	80
3.5	ZC4DX('87) (Opr. 4Z4DX)	430,560	1,318	29	88
7.0	C41A('93) (Opr. T93A)	1,307,944	2,972	34	133
14	9K2GS('97) (Opr. T97M)	1,242,439	2,718	39	140
21	E41/OK1DTP('99)	1,229,728	2,862	40	126
28	4Z5DX('90)	826,759	2,003	39	120

EUROPE

1.8	OHØMEP('95)	251,136	1,451	24	85
3.5	ON4UN('95)	642,600	2,204	35	118
7.0	OK1RF('99)	1,040,910	2,673	39	131
14	OHØBH('94) (Opr. OH2MAM)	1,003,353	2,957	39	130
21	OHØV('99) (Opr. OH6LI)	1,051,380	2,721	38	142
28	SM2EKM('99)	921,193	2,214	40	151

NORTH AMERICA

1.8	VA1A('98) (Opr. K3BU)	246,238	1048	21	85
3.5	NP4A('88) (Opr. K1ZM)	808,640	2,243	31	102
7.0	ZF2TG('92) (Opr. WQ5W)	1,087,862	2,985	31	111
14	KP2A('94) (Opr. KW8N)	1,332,460	3,115	38	132
21	V29W('90) (Opr. KD6WW)	1,110,512	2,829	37	115
28	3E1DX('99) (Opr. DL5XX)	1,472,166	3,913	34	119

OCEANIA

1.8	KH6CC('97)	69,693	593	17	22
3.5	KH2/N2NL('99)	261,352	939	28	76
7.0	9M6NA('97)	1,041,012	2,342	37	116
14	ZL3GQ('91)	1,148,418	2,396	36	126
21	N7DF/NH2('89)	1,205,776	2,977	37	99
28	KH7R('99) (Opr. KH6ND)	1,420,825	3,152	38	123

SOUTH AMERICA

1.8	YV3AGT('85)	147,588	591	21	63
3.5	P4ØJ('95) (Opr. WX4G)	641,245	1,650	28	103
7.0	YV5A('95) (Opr. OHØXX)	1,364,465	3,095	35	122
14	P4ØV('91) (Opr. N7NG)	1,883,700	3,521	38	142
21	ZP5XF('97) (Opr. LU2BRG)	1,926,056	4,009	38	134
28	ZX5J('99) (Opr. N6TJ)	2,131,942	3,962	39	152

Single Operator/All Band

AF	EA8EA('98) (Opr. OH2MM)	13,717,801	6,563	176	543
AS	C4A('98) (Opr. 5B4ADA)	9,904,510	5,508	162	503
EU	LY6M('99) (Opr. LY1DS)	7,140,784	4,634	163	558
NA	8P9Z('98) (Opr. K4BAI)	9,991,863	6,498	155	454
O	9M6NA('99) (Opr. JE1JKL)	7,402,265	4,211	169	442
SA	HC8N('99) (Opr. N5KO)	14,626,579	7,001	185	546
QRP	P4ØW('99) (Opr. W2GD)	5,024,800	3,277	137	413
Low Pwr.	V26K('98) (Opr. AA3B)	7,185,562	5,337	135	406
Asst.	P4ØW('94) (Opr.W2GD)	10,288,950	5,541	155	460

WORLD RECORD

Station	Band	QSOs	Zones	Countries
	1.8	351	19	38
HC8N	3.5	713	27	75
(Opr. N5KO)	7.0	1,144	33	93
(1999)	14.0	1,341	34	104
14,626,579	21.0	1,498	37	120
	28.0	1,954	35	116
	Total	7,001	185	546

Multi-Operator/Single Xmtr.

AF	EA9EA('91)	13,096,080	5,854	170	582
AS	P3A('99)	19,243,476	8,288	191	691
EU	EA6IB('99)	11,670,260	6,712	186	682
NA	8P9Z('99)	18,711,252	8,245	192	669
O	AH2R('99)	9,244,890	4,728	180	515
SA	HC8N('95)	14,302,820	7,252	162	503

WORLD RECORD

Station	Band	QSOs	Zones	Countries
	1.8	264	13	61
P3A	3.5	1,121	27	98
(1999)	7.0	1,535	35	121
19,243,476	14.0	1,825	39	136
	21.0	1,782	39	136
	28.0	1,761	38	139
	Total	8,288	191	691

Multi-Operator/Multi-Xmtr.

AF	CN8WW('99)	70,713,270	23,068	219	843
AS	A61AJ('99)	38,789,751	15,812	213	788
EU	OH2U('99)	22,244,067	10,956	211	786
NA	6Y2A('98)	39,279,140	17,609	192	740
O	KHØAM('92)	23,951,385	11,253	190	527
SA	PJ4B('99)	47,516,600	17,889	208	757

WORLD RECORD

Station	Band	QSOs	Zones	Countries
	1.8	1,694	24	100
CN8WW	3.5	3,248	35	121
(1999)	7.0	4,358	40	141
70,713,270	14.0	4,837	40	159
	21.0	4,319	40	161
	28.0	4,612	40	161
	Total	23,068	219	843

CQ World-Wide DX Contest All-Time U.S.A. Records

BY FREDERICK CAPOSSELA, K6SSS

Tabulated below are the record-high scores achieved by U.S. contesters in the CQ World-Wide DX Contest. Number groups following calls and bands are: year of operation, total score, contacts, zones, and countries.

PHONE

Single Operator/Single Band

1.8	K1ZM('95)	55,420	215	15	70
3.5	K1ZM/2('96)	292,100	952	27	100
7.0	KC7EM('95)	409,446	1,083	34	95
14	K1OX('85) (Opr. KC1F)	1,131,328	2,176	36	140
21	K3RV/4('88)	1,270,478	2,298	39	148
28	W4ZV('99)	1,400,870	2,566	36	154

Single Operator/All Band

Station	Band	QSOs	Zones	Countries
K1AR (1999) 7,898,499	1.8	21	8	15
	3.5	154	16	59
	7.0	231	29	84
	14.0	1,145	38	142
	21.0	1,150	36	123
	28.0	1,393	33	128
	Total	4,094	160	551

QRP

KR2Q('90)	1,246,974	1,069	106	305

Low Power

WA1S('99)	3,064,986	2,015	132	406

Assisted

KI1G('99)	7,639,478	3,403	169	622

Multi-Operator/Single Xmtr.

Station	Band	QSOs	Zones	Countries
K1AR (1990) 11,193,606	1.8	32	12	30
	3.5	197	18	76
	7.0	154	26	95
	14.0	1,370	39	167
	21.0	1,167	38	165
	28.0	1,517	37	170
	Total	4,437	170	703

Multi-Operator/Multi-Xmtr.

Station	Band	QSOs	Zones	Countries
KC1XX (1999) 25,963,386	1.8	197	16	36
	3.5	699	24	102
	7.0	746	31	119
	14.0	2,711	40	185
	21.0	3,245	40	170
	28.0	2,596	36	170
	Total	10,194	187	782

CW

Single Operator/Single Band

1.8	K1ZM('95)	142,358	470	23	83
3.5	K1ZM('92)	416,160	1,059	30	106
7.0	K1ZM('90)	839,520	1,783	34	125
14	K2WK('98)	1,007,781	1,955	39	144
21	K8DX('99)	864,999	1,840	39	138
28	K1RM('99)	789,330	1,689	35	131

Single Operator/All Band

Station	Band	QSOs	Zones	Countries
W4AN (1999) 8,279,616	1.8	41	17	32
	3.5	158	23	69
	7.0	1,247	33	98
	14.0	764	36	106
	21.0	1,018	34	108
	28.0	1,073	32	108
	Total	4,301	175	521

QRP

AA2U('92)	1,188,000	938	118	332

Low Power

N2BA('99)	3,347,190	2,279	133	406

Assisted

K3WW('99)	8,182,098	3,956	176	577

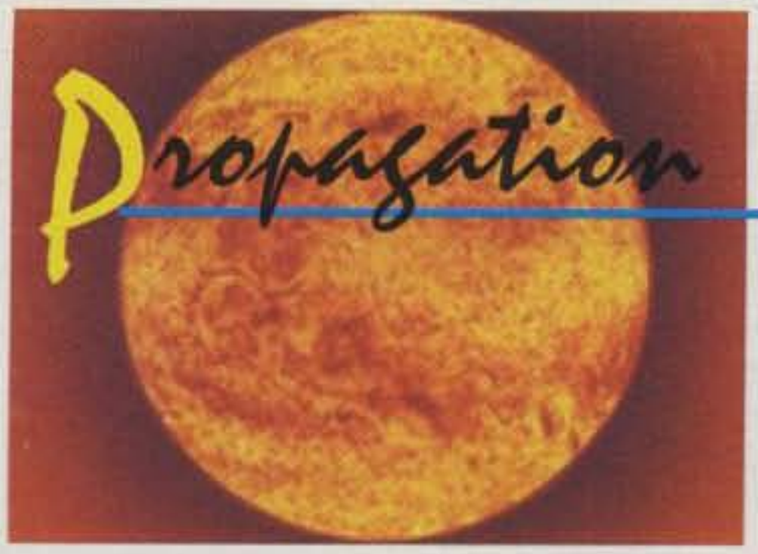
Multi-Operator/Single Xmtr.

Station	Band	QSOs	Zones	Countries
K1AR (1998) 12,063,114	1.8	49	13	46
	3.5	569	27	101
	7.0	1,384	35	136
	14.0	991	38	151
	21.0	999	36	135
	28.0	1083	32	132
	Total	5,074	181	701

Multi-Operator/Multi-Xmtr.

Station	Band	QSOs	Zones	Countries
KC1XX (1999) 24,602,524	1.8	291	23	63
	3.5	1,040	34	116
	7.0	2,119	40	138
	14.0	2,155	40	155
	21.0	2,028	38	150
	28.0	1,947	38	148
	Total	9,580	213	770

Club Record: Yankee Clipper Contest Club ('99) 702,296,971
Team Contesting: Phone – Neiger's Tigers Team #1 ('99) 66,546,582
CW – The Team ('98) 55,385,494



BY GEORGE JACOBS, W3ASK

The Science Of Predicting Radio Conditions

Peak Sunspots for CQ WW Contest

Flash!

What may have been a once-in-a-millennium natural event took place during August 12–13. Just as the *Perseids* meteor shower reached its peak of between 50 and 90 meteors an hour, a geomagnetic storm produced a brilliant widespread auroral display. Star gazers across North America as far south as Los Angeles were treated to a major meteor shower seen against a background of colorful Northern Lights. VHF enthusiasts were treated to a very rare event of independent ionization by both the meteors and the aurora. We will have more on the propagation consequences of this event next month.

The 2000 CQ World-Wide DX Contest will be held during the peak intensity of the present sunspot cycle, Cycle 23. This is an event which occurs about once every 11 years. Table I compares observed sunspot levels during contest periods since 1989, and the level predicted for the 2000 contest. Expect the great HF propagation conditions of last year to repeat again this year, since sunspot counts are similar, with this year expected to be even a bit higher. Statistically, conditions should be better during the 2000 CQ WW DX Contest than any since 1991. Record-breaking scores are likely, barring solar flares or radio storms.

The 2000 contest represents another major event for me personally. This is the 50th consecutive special forecast I have written for the CQ WW DX Contest weekends. I wrote my first one for the 1951 contest and haven't missed one since. The accuracy of the previous 49 contest predictions exceeds 96%!

The 2000 contest will be held on the following dates:

SSB: 0000 UTC Sat., Oct. 28 to 2400 UTC Sun., Oct. 29
CW: 0000 UTC Sat., Nov. 25 to 2400 UTC Sun., Nov 26

If you plan to participate in the contest, the DX Propagation Charts and other information in this month's column is designed to help you stay sharp and informed, and to make the best use of the ionosphere for piling up as many contacts and points as possible.

11307 Clara Street, Silver Spring, MD 20902
e-mail: <george@gjainc.com>

LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for October 2000

	Expected Signal Quality			
Propagation Index.....	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 15-16, 24, 26-27	**A**	**A**	**B**	**C**
High Normal: 1, 8, 10, 17-18, 21-22, 25, 28	**A**	**B**	**C**	**C-D**
Low Normal: 2, 4, 9, 13-14, 19-20, 23, 29, 31	**B**	**C-B**	**C-D**	**D-E**
Below Normal: 3, 5, 7, 12, 30	**C**	**C-D**	**D-E**	**E**
Disturbed: 6, 11	**C-D**	**D**	**E**	**E**

Where expected signal quality is:

A—Excellent opening, exceptionally strong, steady signals greater than S9.

B—Good opening, moderately strong signals varying between S6 and S9+, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S6, with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. **Find the *propagation index* associated with the particular path opening from the Propagation Charts appearing on the following pages.**

2. **With the *propagation index,* use the above table to find the expected signal quality associated with the path opening for any given day of the month. For example, an opening shown in the Propagation Charts with a *propagation index* of 3 will be good (B) on Oct. 1st, fair-to-good (C-B) on the 2nd, fair-to-poor (C-D) on the 3rd, fair-to-good (C-B) on the 4th, fair-to-poor onthe 5th, etc. Good (B) conditions are expected on the first day of the 2000 CQ WW DX SSB Contest, Oct. 28th, and fair-to-good conditions (C-B) on the 29th.**

High to Low Normal Conditions Expected

The best tool available to predict HF propagation conditions in advance is the 27-day recurrence tendencies of geomagnetic, solar, and ionospheric conditions. It is not an absolute method, but it does give a very good indication of what to expect.

Be sure to carefully check conditions on October 1 and 2, since this would be one 27-day cycle before the WW DX SSB Contest weekend of October 28–29. There is better than a 90% chance that conditions observed on those days will recur during the contest weekend.

Based on three 27-day cycles, it looks as if conditions on October 28 likely will be mainly High Normal, possibly increasing to Above Normal at times on mid- and low-latitude openings. Variable conditions are expected on October 29. The day may begin with High Normal conditions, but drop to Low Normal towards the end of the contest when a radio storm may develop, dropping conditions to Below Normal on paths that pass through the auroral zones.

See the "Last-Minute Forecast" for additional information concerning expected day-to-day conditions for the entire month of October. An updated day-to-day forecast for the SSB contest weekend will appear as a bulletin in next month's column. The November issue of *CQ* should reach most subscribers before the SSB Contest begins.

Solar Cycle Progress

Dr. Pierre Cugnon of The Royal Observatory of Belgium, the official keeper of sunspot records, reports a monthly smoothed sunspot number of 125 for June 2000. A high count of 171 was reported for June 14, while a low of 75 occurred on June 3.

June's mean value results in a 12-month running smoothed sunspot number of 111 centered on December 1999. This is the same level as the previous month. A sunspot cycle usually slows down as it approaches peak intensity.

	1989	90	91	92	93	94	95	96	97	98	99	00
October	157	142	142	76	45	27	12	9	32	71	108	116*
November	158	142	138	74	41	26	11	10	35	73	111	115*

**Predicted values expected during the 2000 contest.*

Table I– Smoothed sunspot numbers recorded during CQ World-Wide DX Contests since 1989.

The peak of the present cycle is expected sometime between June and September 2000 with a count of approximately 117. A smoothed sunspot number of approximately 116 forecast for October 2000.

Canada's Dominion Radio Astrophysical Observatory reports a corresponding 10.7 cm solar flux level of 179 for June 2000. This results in a smoothed value of 175 centered on December 1999. A smooth solar flux on the order of 176 is forecast for October.

Band-By-Band Conditions

The following is a band-by-band summary of DX propagation conditions expected from mid-October through mid-December and centered on the WW contest periods.

10 Meters: Best conditions in years expected. Good, solid openings should be possible to just about every corner of the world during the daylight hours, and the band should remain open to southern and tropical regions well into the early evening. Openings towards Europe and in a generally easterly direction should peak an hour or two before noon, while those towards South America and Africa are expected to peak during the early afternoon hours. Optimum conditions towards the Far East, Australia, southeast Asia, etc., are forecast for the late afternoon and early evening hours. Expect exceptionally strong signal levels on most openings, especially if conditions should rise to High or Above Normal.

15 Meters: Fantastic might well describe DX conditions expected on 15 meters! Excellent propagation conditions should exist from shortly after sunrise through the early evening hours, and possibly to as late as midnight. Look for a peak on 15 meters towards a particular geographical area about an hour or so after the peak has occurred to the same geographical area on 10 meters. Expect good, solid openings to all areas of the world, with exceptionally strong signals most of the time. This should be the best band for DX openings during most of the daylight hours, but it could be a toss-up with 10 meters during the afternoon.

20 Meters: DX openings should be possible on this band just about around the clock. Conditions should peak from about an hour or two after sunrise, and again during the late afternoon and early evening hours. Expect to work into most areas of the world between sunrise and sunset. Excellent openings should be possible to many areas of the world well into the hours of darkness as well. When conditions are High or Above Normal, expect 20 meters to remain open for worldwide DX during most of the night. Look for long-path openings for about an hour or so after sunrise and again for an hour or so before local sunset. Signal levels are expected to be exceptionally strong during peak periods of propagation. If you plan to operate on a single band during the contest, this should be it!

40 Meters: The band should be open first for DX towards Europe and in a generally easterly direction during the late afternoon hours, and steadily improve towards evening. During the hours of darkness expect good DX openings to most parts of the world. Signals should peak from an easterly direction about midnight, and from a westerly direction just after sunrise. Conditions towards the south should be excellent throughout the nighttime period. When conditions are no better than Low Normal, 40 meters is likely to be the best band for DX openings during the hours of darkness. When conditions are High or Above Normal, this honor will be shared between 40 and 20 meters.

80 Meters: This should be a good band for DX openings to many areas of the world during the hours of darkness and into the sunrise period. The band should peak towards Europe and in a generally easterly direction around midnight. For openings in a generally westerly direction, expect a peak just after sunrise. The band should remain open towards the south throughout most of the night. Propagation on this band is quite similar to that expected on 40 meters, except signals will be somewhat weaker on the average, noise levels will be a bit higher, and the period for band openings in a particular direction will be a bit shorter.

160 Meters: Expect some DX openings on this band during the hours of darkness and into the sunrise period.

Time EST	Optimum Band (meters)	Areas To Which Band Is To Be Open
00-02	40	Most of Europe, Eastern Mediterranean, and Middle East. Most of Central and South America. A few African areas and possible Antartica.
02-04	20	Some South Pacific, New Zealand, and Autralasia. A few Far East and Asian areas. Some South America and Antarctica.
04-06	40	South Pacific, New Zealand, Autralasia. Many South American areas. A few Far Eastern and Asian areas. Possibly Antarctica.
06-08	20	Most of Europe, South Pacific, New Zealand, and Australasia. Most of Central and South America. A few African areas. Some Far East and Asian areas.
08-10	15	All of Europe, Eastern Mediterranean, and Middle East. Some of Africa. Most of Central and South America. South Pacific, New Zealand, and Australasia. A few Asian areas.
10-12	10	Most of Europe and Africa. Most of Central and South America. A few Asian areas, New Zealand, South Pacific, and Australasia.
12-14	15	Some of Europe and most of Africa. Most of Central and South America. A few areas of South Pacific, New Zealand, and Australasia.
14-16	15	Most of Africa, and Central and South America. Some of South Pacific, New Zealand, and Australasia. A few Asian areas.
16-18	20	Most of Europe, Eastern Mediterranean, and Middle East. All of Africa, and Central and South America. A few Australasian areas.
18-20	15	Lots of South Pacific, New Zealand, and Australasia. Some of Far East and Asia. Most of Central and South America. Possibly Antarctica.
20-22	20	Most of Africa, Far East, South Pacific, New Zealand, Australasia, Central and South America. A few European areas and MIddle East. Some Antarctica.
22-00	20	Lots of Far East, South Pacific, New Zealand, Australasia, Central and South America. A few African and Asian areas. Antarctica.

** Similar work plans can be devised for single-band operation or for openings to specific DX areas.*

Table II– Sample multi-band work plan for eastern US QTH.

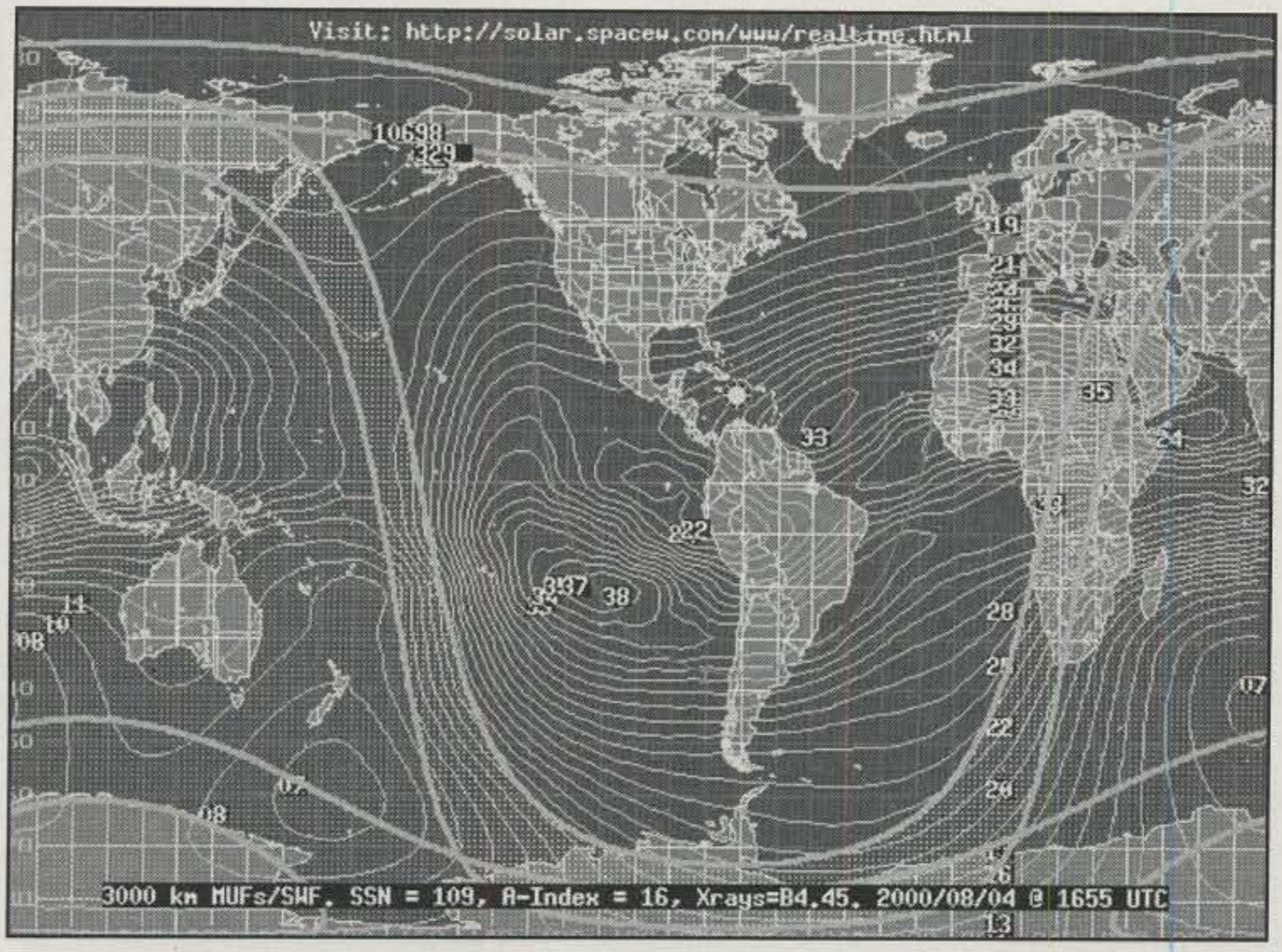


Fig. 1– Real time worldwide MUF, grayline, auroral zone map, and solar and geomagnetic indices. For a complete explanation see the Solar-Terrestrial Dispatch web site at <http://www.spacew.com/www/realtime.html>.

Signals tend to peak at local sunrise at the more easterly terminal of a particular path. Greater ionospheric absorption, higher levels of static, and the lower power levels used on this band should result in generally noisy and weak DX openings, but some good ones should be possible. Look for openings towards Europe and towards the south from the eastern half of the US, and towards the south, the Far East, Australasia, and the South Pacific from the western half of the country. Other DX openings should also be possible. The best propagation aid for this band (and for 80 and 40 meters as well) is a set of sunrise and sunset curves, since DX signals tend to peak when it is local sunrise at the easterly end of the path.

Contest Work Charts

The DX Propagation Charts on the following pages show the times when each amateur band from 10 through 160 meters is expected to open from each time zone area in the continental US to the major DX areas in the world. The information contained in the charts, while useful during the contest period in their present format, can easily be reorganized into more convenient formats to meet specific operational work plans or schedules. Experience gained during previous contests has shown that specifically tailored schedules derived from the charts can be extremely useful in piling up contacts and points with a minimum of wasted time.

Table II is an example of one of several types of plans that can be devised. It is a multi-band operational work plan, which shows the times and bands when propagation conditions are expected to be optimum to various areas of the world for each two-hour period throughout the day. An eastern QTH has been chosen for this example, but similar plans can be devised for central and western locations.

WARC Bands

While the WARC bands are not yet included in the World-Wide DX Contest, expect 12 meter openings during the same time periods as shown for 10 meters, but with the band opening a bit more frequently than 10 meters. Seventeen meters should behave much as shown for 15 meters. Openings on 30 meters should resemble 40 meter openings during local sunrise and sunset times, but the band is expected to open less frequently than 40 meters during the hours of darkness.

Useful Web Sites (URLs)

A wealth of updated and real-time solar, geomagnetic, ionspheric, and HF propagation prediction data can be obtained on the internet from web sites sponsored by well-known research organizations throughout the world. Having such information available, much of it in real time, should be of great help for the 2000 CQ WW DX Contest periods.

For the convenience of readers of this column, I maintain a single web site (<http://www.gjainc.com>) that has links to the following major sources of solar, geomagnetic, ionspheric, and propagation web sites:

N6RT Propagation Report: <http://dx.qsl.net/propagation>. Real-time solar, geomagnetic, auroral, and inonospheric data, and storm warnings updated several times an hour. Includes a real-time MUF map updated every 5 minutes (see fig. 1) and a grayline map.

Solar-Terrestrial Dispatch: <http://www.spacew.com>. Real-time solar, geomagnetic, auroral, and ionospheric data. Section for "Ham Radio." Excellent selection of real-time global ionospheric maps and grayline map (see fig. 1 for global MUF map). Contains a great deal of useful tutorial information.

IPS Australia: <http://www.ips.gov.au>. The IPS Radio and Space Services site in Australia supplies a storehouse of useful real-time solar, geomagnetic, auroral, and ionospheric data, including HF propagation band predictions. Among such forecasts are "Hourly Area Predictions" (HAP). They contain frequency predictions which are superimposed on area maps, given in UT and upgraded every hour. HAPs for North America are available in brilliant color, where different colors represent different frequency ranges. They are available centered on Boston, Boulder, Montreal, New Orleans, San Francisco, Vancouver, White Horse, and Winnipeg. Similar HAPSs are available for the North Atlantic and other major regions of the world. IPS lets you make your own propagation prediction for any path in the world based on real-time data. These are called "Grafex HF Predictions."

DX Listeners Club Norway: <http://www.dxlc.com>. Contains daily values of sunspot numbers, 10.7 cm solar flux, geomagnetic indices, solar wind values, solar flare values, and graphical representation of all sunspot cycles, upgraded daily and achived for a period of a month.

Royal Observatory of Belgium: <http://www.oma.be>. The world's official keeper of sunspot records going back to the 18th century. It is all achived there— daily sunspot numbers, monthly mean numbers and 12-month running smoothed numbers. Updated on the first of the month for the preceding month.

You can dial each URL directly, or reach them through links from my web

site at <http://www.gjainc.com>. If you do not have access to the internet, solar flux, geomagnetic indices, and ionospheric reports can be obtained by calling 303-497-3235, where a WWV recorded announcement is updated every three hours, or by calling the "on duty forecaster" for a live report at the Space Environmental Center, 303-497-3171. The US Air Force Space Weather Program also provides similar real-time HF data which is available by calling 402-294-2272.

WWV, Ft. Collins, Colorado, provides solar and geophysical information and radio storm alerts via HF radio broadcasts 18 minutes past each hour on 2.5, 5, 10, 15, and 20 MHz. Similar information is also carried at 45 minutes past each hour on 2.5, 5, 10, and 15 MHz from WWVH, Kauai, Hawaii.

Fig. 2 can be used to determine the quality of ionspheric propagation by using the solar flux values and geomagnetic indices that are provided by modem, telephone, or radio.

Radio Storm

In the 50 years that I have been preparing these CQ WW DX Contest special columns, I cannot recall any major storms occurring during the contest weekends. Mother Nature seems always to have been cooperative.

While peak sunspot counts mean exceptionally good HF propagation conditions, there is a downside. With an increasing number of spots on the surface of the Sun, there is an increase in solar flare outbursts and the accompanying radio storms. Two such violent storms have occurred recently, on April 6–7 and July 14–15, when most of the ionosphere disappeared for more than a day. At the time of this writing (early August) there appear to be no indications that such a storm will occur during the SSB contest weekend, although some minor storminess may begin towards the very end of the contest. We hope that our "salting the ionosphere" expedition this year to *CQ* headquarters will continue to keep Mother Nature on the side of amateur radio.

If Mother Nature should play a trick and produce a radio storm during the contest periods, expect conditions to drop to Below Normal or Disturbed to many areas of the world, depending on the storm's severity. The storm's influence generally will extend outward from the polar regions, the more severe the storm becomes. Under storm conditions, expect considerably fewer openings on 10, 15, and 20 meters, with weaker signals, increased fading, flutter fading, and higher noise levels. Paths passing through the polar regions and the upper latitudes are often more adversely affected than signals coming from mid- and lower latitudes.

Conditions on 40, 80, and 160 meters are likely to become erratic as well.

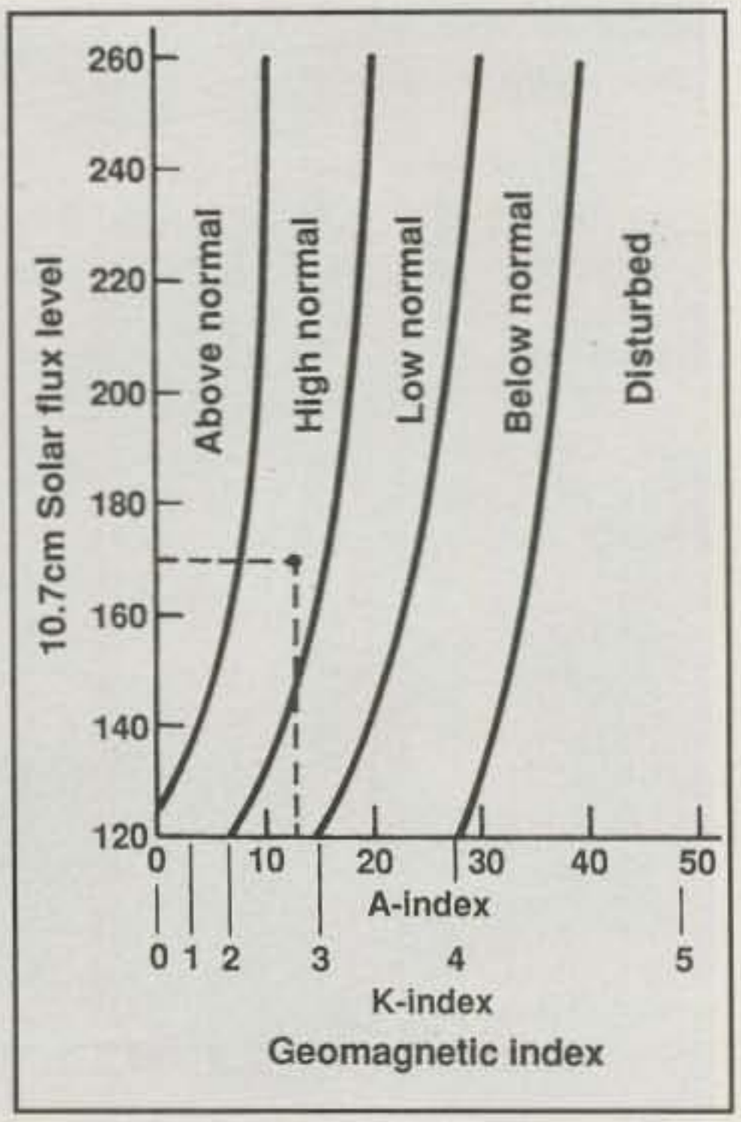


Fig. 2– Intersection of the given values of solar flux and geomagnetic activity determine expected HF ionspheric propagation conditions (i.e., solar Fflux is 170 and A-index is 13; expect High Normal conditions).

During certain types of storms conditions may actualli improve at times for openings on all bands towards southern and tropical areas, and on 40, 80, and 160 meters during the hours of darkness.

If a radio storm should develop, concentrate on working trans-polar paths on 10, 15, and 20 meters during the daylight hours. Check the 40, 80, and 160 meter bands for possible openings to some areas of the world during the hours of darkness.

VHF Ionospheric Propagation

Solar activity is high enough so that exceptionally good DX openings can be expected on the 6 meter band during the hours of daylight. During October it should be possible to work stations in most areas of the world where this band is allocated for amateur use. Although the DX Charts contained in this month's column do not include the 6 meter band directly, 6 meter DX openings can be expected at those times and to those areas of the world where 10 meter openings are shown with a propagation index greater than 3.

Generally speaking, check for openings from the eastern half of the US towards Europe and the east before noon, and towards Africa an hour or so after noon. The best chance for 6 meter

DX openings towards the Caribbean and Central and South America from all areas of the US should be during the afternoon hours. Look for openings towards the Far East, the South Pacific area, New Zealand, and Australasia during the late afternoon hours. These openings will favor stations located in the western half of the US, but some openings should extend considerably eastward. There will be lots of DX surprises in store for the 6 meter band during the next six months, with a good chance for some new DX records to be established.

Trans-continental and 6 meter openings over shorter distances are also expected to increase dramatically during October and the fall, winter, and early spring months, with conditions likely to peak during the afternoon hours.

A major meteor shower, which could produce meteor-reflection-type ionospheric openings on the VHF bands, is expected October 20–22. Called the *Orionids,* the shower should reach peak intensity on October 21, with an hourly meteor count of approximately 25. Peaks in minor meteor showers are expected on October 3 and 12.

Auroral activity generally increases during October, and an increase in auroral-scatter-type VHF openings can be expected. There is also the likelihood for increased short-skip sporadic-*E* propagation resulting from expected auroral activity, particularly on 10 and 6 meters. The best time to check for such openings is when conditions on the HF bands are expected to be Below Normal or Disturbed, as shown in the Last-Minute Forecast at the beginning of this column.

CW Contest Forecast

This month's DX Propagation Charts are valid for both the SSB and CW sections of the contest. Be sure to keep them handy for use during next month's CW section as well. Short-Skip Propagation Charts for use during October appeared last month.

The *NEW Shortwave Propagation Handbook* makes an excellent companion during the CQ WW DX Contest. It contains a considerable amount of additional information concerning propagation, radio storms, do-it-yourself forecasting, and computer propagation programs. Copies can be obtained from *CQ* by calling 1-800-853-9797 ($19.95 plus $4.00 s/h).

Experience from the past 49 contest years has shown that DX contests are excellent periods in which to test the accuracy of prediction and forecast methods used in this column. Contests generate a large amount of activity in every corner of the world and on all HF bands. Previous results and observations have helped considerably in improving the accuracy of this column. Comments concerning the 2000 contest and the accuracy of these forecasts and predictions would be appreciated, and should be sent to W3ASK, at P.O. Box 1714, Silver Spring, MD 20915, or e-mailed to <george@gjainc.com>.

73, George, W3ASK

HOW TO USE THE DX PROPAGATION CHARTS

1. Use chart appropriate to your transmitter location. The Eastern USA Chart can be used in the 1, 2, 3, 4, 8, KP4, KG4, and KV4 areas in the USA and adjacent call areas in Canada; the Central USA Chart in the 5, 9, and 0 areas; the Western USA Chart in the 6 and 7 areas; and with somewhat less accuracy in the KH6 and KL7 areas.

2. The predicted times of openings are found under the appropriate meter band column (15 through 80 meters) for a particular DX region, as shown in the left-hand column of the charts. An * indicates the best time to listen for 160 meter openings. An ** indicates best time to check for 10 meter openings.

3. The propagation index is the number that appears in ( ) after the time of each predicted opening. The index indicates the number of days during the month on which the opening is expected to take place as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual dates on which an opening with a specific *propagation index* is likely to occur, and the signal quality that can be expected.

4. Times shown in the charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 A.M.; 13 is 1 P.M., etc. Appropriate *standard* time is used, not GMT. To convert to GMT, add to the times shown in the appropriate chart 8 hours in PST Zone, 7 hours in MST Zone, 6 hours in CST Zone, and 5 hours in EST Zone. For example, 13 hours in Washington, D.C. is 18 GMT. When it is 20 hours in Los Angeles, it is 04 GMT, etc.

5. The charts are based upon a transmitted power of 250 watts CW, or 1 kw, PEP on sideband, into a dipole antenna a quarter-wavelength above ground on 160 and 80 meters, and a half-wavelength above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 dB gain above these reference levels, the *propagation index* will increase by one level; for each 10 dB loss, it will lower by one level.

6. Propagation data contained in the charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept of Commerce, Boulder, Colorado 80302.

October 15 - December 15, 2000
Time Zone: EST (24-Hour Time)
EASTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Central Europe & North Africa	06-07 (1) 07-08 (3) 08-13 (4) 13-14 (3) 14-15 (1)	06-07 (1) 07-08 (3) 08-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	04-06 (2) 06-09 (4) 09-10 (3) 10-12 (2) 12-14 (3) 14-18 (4) 18-20 (3) 20-22 (2) 22-00 (1) 00-02 (2) 02-04 (3)	16-17 (1) 17-18 (2) 18-20 (3) 20-01 (4) 01-02 (3) 02-03 (2) 03-04 (1) 19-21 (1)* 21-23 (2)* 23-01 (3)* 01-02 (2)* 02-03 (1)*
Northern Europe & European CIS	06-07 (1) 07-08 (2) 08-09 (3) 09-11 (4) 11-12 (2) 12-13 (1)	06-07 (1) 07-08 (3) 08-13 (4) 13-14 (3) 14-15 (1)	04-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-17 (3) 17-19 (4) 19-21 (3) 21-23 (2) 23-01 (3) 01-04 (2)	17-19 (1) 19-02 (2) 02-04 (1) 20-03 (1)*
Eastern Mediterranean & Middle East	07-08 (1) 08-09 (3) 09-13 (4) 13-14 (3) 14-15 (1)	06-07 (1) 07-08 (3) 08-10 (4) 10-13 (3) 13-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	07-12 (1) 12-15 (2) 15-17 (3) 17-22 (4) 22-00 (3) 00-01 (2) 01-03 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-01 (2) 01-02 (1) 20-00 (1)*
Western Africa	06-07 (1) 07-12 (3) 12-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	04-05 (1) 05-07 (2) 07-14 (3) 14-20 (4) 20-22 (3) 22-00 (2) 00-01 (1)	03-04 (3) 04-06 (2) 06-13 (1) 13-15 (2) 15-17 (3) 17-03 (4)	18-22 (1) 22-01 (2) 01-03 (1) 00-03 (1)*
Eastern & Central Africa	07-08 (1) 08-09 (2) 09-12 (3) 12-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	06-07 (1) 07-09 (3) 09-13 (2) 13-15 (3) 15-18 (4) 18-19 (3) 19-22 (2) 22-00 (1)	03-05 (2) 05-09 (1) 12-14 (1) 14-16 (2) 16-17 (3) 17-01 (4) 01-03 (3)	19-22 (1) 22-00 (2) 00-01 (1) 22-00 (1)*
Southern Africa	07-08 (1) 08-10 (3) 10-14 (4) 14-16 (3) 16-17 (2) 17-18 (1)	06-08 (1) 08-11 (2) 11-13 (3) 13-16 (4) 16-18 (3) 18-20 (2) 20-22 (1)	06-09 (1) 11-14 (1) 14-15 (2) 15-17 (3) 17-21 (4) 21-02 (3) 02-05 (2)	18-19 (1) 19-22 (2) 22-23 (1) 19-21 (1)*
Central & South Asia	08-09 (1) 09-10 (2) 10-11 (1) 20-22 (1)	07-08(1) 08-10 (2) 10-11 (1) 18-20 (1) 20-22 (2) 22-00 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-11 (1) 18-20 (1) 20-21 (2) 21-23 (3) 23-00 (2) 00-01 (1)	18-21 (1) 06-08 (1)
Southeast Asia	10-12 (1) 12-14 (2) 14-15 (1) 17-18 (1) 18-20 (2) 20-21 (1)	09-10 (1) 10-12 (2) 12-13 (1) 17-18 (1) 18-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	02-06 (1) 06-09 (2) 09-11 (1) 18-21 (2) 21-23 (1)	18-20 (1) 05-07 (1)
Far East	08-10 (1) 16-17 (1) 17-18 (2) 18-20 (3) 20-21 (1)	08-09 (1) 09-11 (2) 11-12 (1) 16-17 (1) 17-18 (2) 18-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	00-04 (2) 04-06 (1) 06-07 (2) 07-09 (3) 09-10 (2) 10-11 (1) 16-18 (1) 18-20 (2) 20-00 (3)	04-05 (1) 05-07 (2) 07-08 (1) 05-07 (1)*
South Pacific & New Zealand	09-12 (1) 12-14 (2) 14-16 (3) 16-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	08-09 (1) 09-11 (2) 11-15 (1) 15-17 (2) 17-18 (3) 18-20 (4) 20-21 (3) 21-23 (2) 23-00 (1)	13-19 (1) 19-21 (2) 21-22 (3) 22-02 (4) 02-04 (3) 04-07 (2) 07-10 (3) 10-13 (2)	00-02 (1) 02-03 (2) 03-07 (3) 07-08 (2) 08-09 (1) 03-04 (1)* 04-07 (2)* 07-08 (1)*
Australasia	08-09 (1) 09-11 (2) 11-12 (1) 14-16 (1) 16-17 (2) 17-18 (3) 18-19 (4) 19-20 (2) 20-21 (1)	07-08 (1) 08-11 (2) 11-16 (1) 16-17 (2) 17-18 (3) 18-20 (4) 20-22 (3) 22-23 (2) 23-00 (1)	07-08 (3) 08-10 (4) 10-11 (3) 11-12 (2) 12-14 (1) 17-19 (2) 21-23 (1) 23-00 (2) 00-01 (3) 01-03 (4) 03-04 (3) 04-07 (2)	03-05 (1) 05-07 (2) 07-08 (1) 05-07 (1)*
Caribbean, Central America & Northern Countries of South America	07-08 (2) 08-11 (4) 11-13 (3) 13-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	06-07 (1) 07-08 (3) 08-11 (4) 11-13 (3) 13-20 (4) 20-21 (3) 21-23 (2) 23-01 (1)	07-09 (4) 09-11 (3) 11-14 (2) 14-16 (3) 16-02 (4) 02-03 (3) 03-06 (2) 06-07 (3)	18-19 (1) 19-21 (3) 21-04 (4) 04-06 (2) 06-07 (1) 19-21 (1)* 21-03 (2)* 03-05 (1)
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	06-07 (1) 07-09 (4) 09-11 (3) 11-15 (2) 15-16 (3) 16-20 (4) 20-21 (2) 21-22 (1)	06-07 (1) 07-09 (4) 09-11 (3) 11-15 (2) 15-17 (3) 17-22 (4) 22-23 (3) 23-00 (2) 00-01 (1)	06-08 (2) 08-11 (1) 14-16 (1) 16-17 (2) 17-19 (3) 19-02 (4) 02-03 (3) 03-05 (2) 05-06 (3)	20-23 (1) 23-04 (2) 04-06 (1) 23-04 (1)*

McMurdo Sound, Antarctica	16-17 (1) 17-19 (2) 19-20 (1)	15-17 (1) 17-18 (2) 18-21 (3) 21-22 (2) 22-23 (1)	16-18 (1) 18-21 (1) 21-22 (2) 22-03 (3) 03-05 (2) 05-07 (1) 07-09 (2) 09-10 (1)	00-06 (1)

Time Zones: CST & MST (24-hour time) CENTRAL USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40-80 Meters*
Western & Southern Europe & North Africa	06-07 (1) 07-08 (3) 08-11 (4) 11-12 (3) 12-13 (2) 13-14 (1)	06-07 (1) 07-08 (3) 08-12 (4) 12-13 (3) 13-14 (2) 14-15 (1)	03-06 (1) 06-08 (3) 08-12 (2) 12-14 (3) 14-16 (4) 16-18 (3) 18-20 (2) 20-00 (1) 00-03 (2)	17-18 (1) 18-20 (2) 20-23 (3) 23-01 (2) 01-02 (1) 19-20 (1)* 20-23 (2)* 23-00 (1)*
Northern & Central Europe & European CIS	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1)	06-07 (1) 07-08 (3) 08-11 (4) 11-12 (3) 12-13 (2) 13-14 (1)	02-06 (1) 06-07 (2) 07-09 (3) 09-11 (2) 11-16 (3) 16-17 (4) 17-19 (3) 19-20 (2) 20-22 (1) 22-02 (2)	18-20 (1) 20-23 (2) 23-01 (1) 20-23 (1)*
Eastern Mediter-ranean & Middle East	07-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-14 (1)	06-07 (1) 07-08 (2) 08-11 (3) 11-12 (4) 12-13 (3) 13-14 (2) 14-15 (1)	06-07 (1) 07-09 (2) 09-11 (1) 11-13 (2) 13-16 (3) 16-18 (4) 18-20 (3) 20-22 (2) 22-00 (1)	17-19 (1) 19-22 (2) 22-23 (1) 20-22 (1)*
Western Africa	06-07 (1) 07-11 (3) 11-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	05-06 (1) 06-10 (2) 10-14 (3) 14-18 (4) 18-19 (3) 19-21 (2) 21-22 (1)	05-12 (1) 12-15 (2) 15-17 (3) 17-23 (4) 23-01 (3) 01-05 (2)	17-19 (1) 19-21 (2) 21-22 (1) 19-21 (1)*
Eastern & Central Africa	07-09 (1) 09-11 (2) 11-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-12 (2) 12-15 (3) 15-17 (4) 17-18 (3) 18-20 (2) 20-21 (1)	06-14 (1) 14-16 (2) 16-19 (3) 19-21 (4) 21-23 (3) 23-00 (2) 00-02 (1)	20-00 (1) 21-23 (1)*
Southern Africa	07-08 (1) 08-09 (2) 09-11 (3) 11-14 (4) 14-15 (3) 15-16 (2) 16-17 (1)	06-07 (1) 07-10 (2) 10-12 (3) 12-15 (4) 15-17 (3) 17-18 (2) 18-20 (1)	06-13 (1) 13-15 (2) 15-17 (3) 17-20 (4) 20-23 (3) 23-02 (2) 02-04 (1)	18-19 (1) 19-21 (2) 21-22 (1) 19-21 (1)*
Central & South Asia	07-08 (1) 08-10 (2) 10-11 (1) 18-19 (1) 19-21 (2) 21-22 (1)	06-07 (1) 07-10 (2) 10-11 (1) 17-18 (1) 18-19 (2) 19-21 (3) 21-22 (2) 22-23 (1)	04-06 (1) 06-07 (2) 07-09 (3) 09-10 (2) 10-11 (1) 17-18 (1) 18-19 (2) 19-21 (3) 21-23 (2) 23-02 (1) 02-04 (2)	18-20 (1) 06-08 (1)
Southeast Asia	07-08 (1) 08-09 (2) 09-10 (3) 10-11 (2) 11-13 (1) 15-16 (1) 16-19 (2) 19-20 (1)	07-08 (1) 08-09 (2) 09-10 (3) 10-12 (2) 12-13 (1) 16-17 (1) 17-18 (2) 18-20 (3) 20-21 (2) 21-22 (1)	06-07 (1) 07-10 (2) 10-12 (1) 18-19 (1) 19-21 (2) 21-23 (1)	04-07 (1)
Far East	15-16 (1) 16-19 (3) 19-20 (2) 20-21 (1)	08-10 (1) 15-16 (1) 16-17 (3) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	04-05 (1) 05-07 (2) 07-09 (3) 09-10 (2) 10-11 (1) 17-19 (1) 19-20 (2)	02-03 (1) 03-07 (2) 07-09 (1) 03-06 (1)*
Far East			20-22 (3) 22-23 (2) 23-00 (1)	
South Pacific & New Zealand	09-12 (1) 12-13 (2) 13-15 (3) 15-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	08-11 (1) 11-13 (3) 13-16 (2) 16-17 (3) 17-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	11-17 (1) 17-18 (2) 18-20 (3) 20-01 (4) 01-03 (3) 03-07 (2) 07-09 (4) 09-10 (3) 10-11 (2) 11-12 (2)	23-01 (1) 01-02 (2) 02-07 (3) 07-08 (2) 08-09 (1) 00-02 (1)* 02-07 (2)* 07-08 (1)*
Australasia	08-09 (1) 09-11 (2) 11-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-20 (2) 20-21 (1)	06-08 (1) 08-09 (3) 09-11 (2) 11-12 (1) 16-18 (1) 18-19 (2) 19-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	06-07 (2) 07-09 (4) 09-10 (3) 10-11 (2) 11-12 (1) 15-17 (1) 20-22 (1) 22-00 (2) 00-04 (3) 04-06 (1)	02-04 (1) 04-07 (2) 07-08 (1) 03-04 (1)* 04-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	06-07 (1) 07-08 (3) 08-10 (4) 10-12 (3) 12-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	05-06 (1) 06-07 (2) 07-08 (3) 08-10 (4) 10-13 (3) 13-18 (4) 18-19 (3) 19-21 (2) 21-23 (1)	06-07 (3) 07-09 (4) 09-11 (3) 11-14 (2) 14-16 (3) 16-00 (4) 00-02 (3) 02-06 (2)	18-19 (1) 19-21 (3) 21-03 (4) 03-05 (2) 05-07 (1) 19-21 (1)* 21-02 (2)* 02-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina, & Uruguay	06-07 (1) 07-08 (3) 08-10 (4) 10-14 (3) 14-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	05-06 (1) 06-07 (2) 07-09 (3) 09-13 (2) 13-15 (3) 15-20 (4) 20-21 (3) 21-23 (2) 23-00 (1)	04-06 (1) 06-08 (2) 08-14 (1) 14-16 (2) 16-18 (3) 18-00 (4) 00-02 (3) 02-04 (2)	19-21 (1) 21-01 (2) 01-03 (1) 03-04 (2) 04-06 (1) 21-05 (1)*
McMurdo Sound, Antarctica	07-08 (1) 08-09 (2) 09-10 (1) 17-18 (1) 18-20 (2) 20-21 (1)	06-07 (1) 07-09 (2) 09-10 (1) 14-16 (1) 16-18 (2) 18-22 (3) 22-23 (2) 23-00 (1)	06-08 (2) 08-09 (1) 16-18 (1) 18-20 (2) 20-02 (3) 02-04 (2) 04-06 (1)	23-05 (1)

Time Zone: PST (24-hour time) WESTERN USA TO:

	10 Meters	*15 Meters*	*20 Meters*	*40/80 Meters*
Western & Southern Europe & North Africa	06-07 (1) 07-08 (2) 08-11 (3) 11-12 (2) 12-13 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (4) 12-13 (2) 13-14 (1)	05-06 (1) 06-08 (2) 08-10 (1) 10-12 (2) 12-14 (4) 14-16 (3) 16-18 (2) 18-20 (1) 23-01 (2)	18-20 (1) 20-22 (2) 22-00 (1) 19-23 (1)*
Central & Northern Europe & European CIS	07-08 (1) 08-10 (2) 10-11 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1)	05-07 (1) 07-09 (3) 09-10 (2) 10-14 (1) 14-17 (3) 17-19 (2) 19-23 (1) 23-02 (2) 02-03 (1)	18-20 (1) 20-22 (2) 22-23 (1) 19-22 (1)*
Eastern Mediter-ranean & Middle East	07-08 (1) 08-10 (2) 10-11 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1)	06-07 (1) 07-10 (2) 10-14 (1) 14-16 (2) 16-18 (1) 18-20 (2) 20-22 (1) 00-02 (1)	18-22 (1) 06-08 (1)
Western Africa	06-07 (1) 07-08 (2) 08-11 (3) 11-13 (4) 13-15 (3) 15-16 (2) 16-17 (1)	05-06 (1) 06-07 (2) 07-13 (3) 13-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	05-10 (1) 10-14 (2) 14-15 (3) 15-20 (4) 20-22 (3) 22-02 (2) 02-03 (1)	18-19 (1) 19-21 (2) 21-22 (1) 19-21 (1)*
Eastern & Central Africa	07-08 (1) 08-10 (2) 10-14 (3)	06-08 (1) 08-12 (2) 12-16 (3)	06-14 (1) 14-16 (2) 16-22 (3)	18-21 (1) 06-08 (1)
Southern Africa	07-08 (1) 08-09 (2) 09-10 (1) 10-11 (2) 11-12 (1) 12-13 (2) 13-14 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-12 (2) 12-14 (3) 14-15 (2) 15-16 (1)	06-08 (1) 08-10 (2) 10-12 (3) 12-14 (4) 14-16 (3) 16-18 (2) 18-20 (1) 20-22 (1) 22-23 (1)	18-21 (1) 21-22 (2) 22-23 (1) 23-00 (1)*
Central & South Asia	07-08 (1) 08-10 (2) 10-11 (1) 11-12 (2) 12-13 (1) 13-14 (2) 14-15 (1) 15-16 (2) 16-17 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1) 12-13 (2) 13-14 (1) 14-15 (2) 15-16 (1)	06-07 (1) 07-09 (3) 09-10 (2) 10-11 (1) 16-17 (1) 17-19 (3) 19-21 (2) 21-22 (1)	17-19 (1) 04-09 (1)
Southeast Asia	08-09 (1) 09-10 (3) 10-11 (4) 11-12 (3) 12-13 (2) 13-14 (1) 14-15 (2) 15-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	07-08 (1) 08-11 (3) 11-12 (2) 12-15 (1) 15-17 (3) 17-19 (2) 19-21 (3) 22-23 (1)	06-07 (1) 07-08 (2) 08-10 (3) 10-11 (2) 11-12 (1) 19-22 (1) 22-01 (2) 01-03 (3) 03-06 (2)	02-03 (1) 03-06 (2) 06-08 (1) 03-06 (1)*
Far East	13-14 (1) 14-15 (3) 15-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	07-08 (1) 08-09 (2) 09-11 (3) 11-13 (2) 13-15 (3) 15-17 (2) 17-19 (4) 19-20 (3) 20-21 (2) 21-22 (1)	06-07 (1) 07-08 (2) 08-10 (4) 10-12 (3) 12-14 (2) 14-18 (1) 18-20 (2) 20-21 (3) 21-23 (4) 23-02 (3)	23-01 (1) 01-05 (2) 05-07 (3) 07-08 (1) 01-05 (1)* 05-06 (2)* 06-07 (1)*
South Pacific & New Zealand	08-09 (1) 09-10 (2) 10-19 (4) 19-21 (3) 21-23 (2) 23-00 (1)	07-08 (1) 08-11 (4) 11-18 (3) 18-00 (4) 00-02 (3) 02-03 (2) 03-04 (1)	11-18 (1) 18-19 (2) 19-21 (3) 21-04 (4) 04-07 (3) 07-09 (4) 09-10 (3) 10-11 (2)	21-22 (1) 22-00 (2) 00-07 (3) 07-08 (2) 08-09 (1) 22-00 (1)* 00-06 (2)* 06-07 (1)*
Australasia	09-11 (1) 11-12 (2) 12-14 (4) 14-18 (3) 18-20 (4) 20-21 (3) 21-22 (2) 22-23 (1)	07-08 (1) 08-12 (3) 12-14 (2) 14-18 (1) 18-20 (2) 20-21 (3) 21-00 (4) 00-01 (3) 01-02 (2) 02-03 (1)	18-20 (1) 20-22 (2) 22-00 (3) 00-04 (4) 04-07 (3) 07-09 (4) 09-10 (3) 10-12 (2) 12-14 (1)	02-03 (1) 03-04 (2) 04-07 (3) 07-08 (1) 03-04 (1)* 04-06 (2)* 06-07 (1)*
Caribbean, Central America & Northern Countries of South America	06-07 (1) 07-08 (3) 08-10 (4) 10-12 (3) 12-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	05-06 (1) 06-07 (2) 07-10 (4) 10-13 (3) 13-18 (4) 18-19 (3) 19-21 (2) 21-22 (1)	06-07 (3) 07-09 (4) 09-10 (3) 10-13 (2) 13-15 (3) 15-23 (4) 23-01 (3) 01-06 (2)	18-19 (1) 19-21 (3) 21-02 (4) 02-05 (2) 05-06 (1) 19-21 (1)* 21-02 (2)* 02-05 (1)*
Peru, Bolivia, Paraguay, Brazil, Chile, Argentina & Uruguay	06-07 (1) 07-13 (3) 13-17 (4) 17-18 (3) 18-19 (2) 19-20 (1)	05-06 (1) 06-07 (2) 07-09 (3) 09-13 (2) 13-15 (3) 15-20 (4) 20-22 (3) 22-00 (2) 00-01 (1)	12-14 (1) 14-16 (2) 16-18 (3) 18-23 (4) 23-01 (3) 01-03 (2) 03-05 (1) 05-07 (2) 07-09 (1)	20-22 (1) 22-04 (2) 04-05 (1) 22-04 (1)*
McMurdo Sound, Antarctica	07-08 (1) 08-09 (2) 09-10 (1) 19-20 (1) 20-22 (2) 22-23 (1)	06-07 (1) 07-09 (2) 09-12 (1) 14-17 (1) 17-20 (2) 20-23 (3) 23-01 (2) 01-02 (1)	16-18 (1) 18-20 (2) 20-04 (3) 04-05 (2) 05-06 (1) 06-08 (2) 08-10 (1)	00-05 (1)

*Indicates best time to listen for 80 meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a propagation index of (2) or higher.
For 12 meter openings interpolate between 10 and 15 meter openings.
For 17 meter openings interp[olate between 15 and 20 meter openings.
For 30 meter openings interpolate between 40 and 30 meter openings.

pile-up gave 0.1 meg points. It was a pity that power-line breaks consumed much time (4 hours of operation with diesel engine). Our result could have been better. We spent 22 weekends at the site of RU1A before CQ WW in hard work...***RU1A.*** It was very good propagation on 10m. All antennas are homemade. I like working QRP! I listened good activity from USA...***RZ6HX.*** Many station heard, but not everybody heard me (hi)...***RZ9CX.***

My firstborn son, Martin, was born just 9 minutes before the beginning of the contest, so I have been "radioactive" only for few hours on Sunday...***S53AU.*** Everything looked just perfect 'til Sunday morning. Then Murphy comes around! Looks like a heavy-duty truck full of workers set to change the line transformer for the whole city quarter. Power's gone for 7 hours. Would certainly approve their action if it just wasn't so ill-timed! This was a real DXpedition, carrying all equipment and antennas and setting up everything from 160 to 10m in just two days prior to the contest. When you show up at the check-in window with over 80 kilograms of equipment, you certainly don't qualify for any discounts on the access baggage...***E4/S53R.*** First time I was QRV on each band with 2 ant, but day before contest big storm destroyed 4 ant. This is reason for lower scores on 21 and 14 MHz. On 1.8 and 80m big QRM all time...***S58A.*** Lost second ants due to icy/fog after 18 hours. Surprised to be called by T32PO, FK8GM, KH8/N5OLS, V8A, R1AND, AP2, TZ6,TU2, and many other rare DX! Good condx and also some aurora at the end so all sigs have been ringing and lot of echoes...***S59A.*** The location here is very effective. With one beam heading (330) we worked all Ws, whole EU and JA. We have them all within one minute sometimes. It was strange that we did not work a single JA on 15m. Saturday afternoon 10/15/20m were totally dead for about 2 hours...***S92CW.*** Greatest surprise: being called by 6D2X on my CQ. Worst surprise: hearing SP5? three times in a row sent by AL7IF (needed double multiplier) in terrible pile-up and finally he made QRT!...***SP5DDJ.***

During the contest sailed from 40.30'S 060.20'W to 49.30'S 058.30'W (to VP8/f). For 8 hours I loaded 35 kg fish cartons into holds on Saturday (for a change, hi). Never believe those who say "your barefoot TRX and vertical are doing FB job." Life is too short for QRP and small antennas!...***UA2FM/mm.*** Nice contest, but very hard to work a DX with 150W even with good antennas!...***UR5WCW.*** Enjoyed the contest but missing zone 13 was a shock...***US5WE.*** First time single band (40m) operation. Just three DXpeditions are passed from the announced list. NA QSOs equal EU QSOs = 40% + 40% (600 Q's each)! Enjoyable experience! 30 Q's only behind of '93s zone 16 leaders result...***UX1UA.*** I was not able to operate the last 8 hours of the contest due to a power outage here on Kwajalein, so I grit my teeth and sadly "threw in the towel." After all the hours of operating alone, the power man down the road did not want to see me coming...***V73CW.*** I never had such huge pile-ups! Thanks to all who moved for me as well as to VE2CSI club and personally to VE2NN for letting me use club's facilities...***VE2IM (VA3UZ).*** A great weekend, and a great contest...***VE6EX.*** My very first attempt at a contest with an official entry. Look out next year...***VE6TN.*** My first semi-serious try, from a city lot. Amazingly consistent signals from CN8WW on all bands...***VE7XF.*** I enjoyed plenty of fun and sleep in the single band 20m entry. It was great working many strong signals on long path USA, east to west. My bonus was to pass the zone 30 and Australian records (20m single band high power) set in 1989. After 20m closed, I was pleased to give zone 30 to 221 stations on 10m during the last 100 minutes. A separate check log has been forwarded for the 10m QSOs. Special thanks for pointing your beams to Australia...***VK4EMM.***

Wow, 10m was hot! I've never heard the band so open. Must be that contest-induced propagation! I even got 9G long path for an all-time new CW DX QSO...***VK4ICU.*** Had to be out Saturday morning. Have been getting too addicted to running so thought it was time for a bit of masochism operating 80m. Really hard work from down here with summer static to add to the joy. We don't give enough credit to operators who do this contest after contest at multi-multis. All the glory goes to the single ops on an island near the equator with their fast runs, which is easy compared to 48 hours on 80!...***VK5GN.*** I was surprised at the amount of activity. The YB/BV/BY intruders got a real shock—for a change!! Once again, I had a hard time trying to make QSOs while fighting the NA/EU/JA clique!! I also spent a lot of time making and keeping skeds, and QSYing, for people wanting zone 29, to the detriment of my own score!! This, too, will be noticed in the log...***VK8AV*** *(Your QSYing is really appreciated by many contesters!..ed.)*. While some may complain about a lot of lids on the air, I must say that there are a lot of *great* ops on the air who really know the code. Thanks to all for a really fun contest...***VP5GN (K5GN).*** This is my second CQ WW CW Contest. Band conditions are picking up...***YBØUNC.*** Glad to get JT1JA on topband after waiting; his/her signal peaked for 80 minutes!...***YCØLOW.*** I used a computer for the very first time in a contest. What a relief making the log. Bye-bye, paperwork!...***YU7WJ.***

Tropical fever hit. Had to stop Saturday morning!...***YV4A (OHØXX).*** I again operated from the Quartz Hill Amateur Radio station ZL6QH. I was disappointed with a lower score than last year. Activity and conditions appeared to be generally poorer on all bands. A mains power failure at 1300 on Sunday did not help; had to start up the petrol generator and run the station at reduced power for several hours! Thanks to the organizers for another fun contest...***ZL6QH (ZL1AZE).*** Thanks to Steve, G4EDG, for popping down, radiation hardened from ZK3, to help out. I reckon Steve is probably responsible for single-handedly scoring two thirds of our run QSOs, and he carries on what is starting to become a tradition of excellent CW guest ops from G-land. Low point: turning up with a box full of cans of "contest spaghetti" and baked beans and sausage, only to find the microwave oven gone. High point: Tony's wife Mary arriving with a carload of food: Shepherd's pie, bowls with nuts, raisins, strawberries, a huge bowl of lovely creamy desert with bits of kiwi fruit, and, a stroke of genius—a square meter slab of chocolate! Witnessing 15m signals from Scandinavia wrap around the globe a few times,. I quickly recorded a bit of OH1JD in a WAV file. At times the callsign can be heard almost twice...***ZM2K.*** 10m conditions made up for the disastrous antenna project and power line noise. I had to snatch some sleep in the middle, but whenever I was awake the band was open to somewhere...***ZS6EZ.*** Saturday morning somebody switched the sun off; all bands suddenly died. A great contest though...***ZZ2Z (PY2YP).***

CLUB SCORES

USA

Yankee Clipper Contest Club	702,296,971
Frankford Radio Club	561,848,239
Potomac Valley Radio Club	247,145,726
North Coast Contesters	98,919,747
Society of Midwest Contesters	77,992,687
Northern California Contest Club	65,879,656
Southern California Contest Club	49,878,519
Mad River Radio Club	48,330,781
Southeast Contest Club	45,835,590
North Texas Contest Club	40,815,413
Florida Contest Group	40,087,806
Central Arizona DXA	33,523,262
Tennessee Contest Group	24,494,914
Minnesota Wireless	23,652,945
Rochester DX Assn.	21,528,184
Western Washington DX Club	20,660,984
Eastern Iowa DX Assn	19,977,008
Texas DX Society	17,920,728
Florida Contest Club	17,812,634
Central Texas DXCC	17,804,977
San Diego DX Club	16,601,478
North Florida DX Assn	16,109,094
Southwest Ohio DXA	14,730,906
Western New York DX Assn.	11,024,969
Willamette Valley DX Club	9,184,315
Kentucky Contest Group	9,014,144
Carolina DX Assn	8,380,897
Grand Mesa DX Club	6,496,513
Yegua Valley Contest Club	6,395,019
Hudson Valley DXCC (W2)	5,438,434
Mother Lode Contest & DXC (W6)	4,140,014
Southeast DX Club	3,949,037
Northern Arizonia DXA	3,128,279
Salt City DX Club (W2)	2,809,304
Mile-High DX Assn (WØ)	2,544,823
Ozark Contest Club (W5)	2,107,542
Kansas City DX Club	1,888,018
Metro DX Club(W9)	1,309,777
CA Central Coast DX Club	1,246,411
Order of Boiled Owls (NY)	992,567
Athens Co. ARA	959,380
West Park Radio Ops (W8)	753,154
Mississippi Valley DXCC	682,805
American Red Cross EC (W2)	681,897
Southern California DX Club	659,031
Great South Bay ARC	658,702
Magnolia DX Assn (W5)	633,791
Oklahoma Dx Assn	592,158
Sterling Park ARC (W4)	448,788
HeartLand DX Assn	443,761
Northern California DX Club	385,910
Northrop-Grumman RC	335,953
Ozaukee Radio Club (W9)	241,092

DX

Bavarian Contest Club	239,287,350
Contest Club Finland	200,725,281
Rhein-Ruhr DX Assn	183,847,231
Marconi Contest Club	94,275,019
Slovenian Contest Club	90,085,930
Ural Contest Group	61,919,511
Chiltern DX Club	46,934,821
Aphrodite Contest Group (5B4)	46,383,992
UA2 Contest Club	45,992,538
Russian Contest Club	44,238,852
Kaunas Technical University RC	38,388,548
Japan Crazy Contesters Club	37,796,060
Croatian Contest Club	37,117,717
Low Land Crazy Contesters	34,345,146
GPDX (CT)	34,224,609
Top of Europe Contesters	32,613,683
SP DX Club	32,141,919
YU Contest Club	31,685,694
LNDX (F)	29,270,509
Lithuanian DX Group	28,946,119
Ukrainian Contest Club	28,119,832
French Contest Club	27,173,266
LA Contest Club(LA)	24,427,992
Vojvodina Contest Club (YU)	22,601,142
Crimea Contest Club	21,275,692
Czech Contest Club	19,490,782
Moscow Contest Club	17,531,812
Northern Lithuania DX Group	15,069,872
Berghem Contest Club (I2)	13,776,852
Aruba ARC	13,126,564
TuPY (PY2)	12,873,398
Lynx DX Gang (EA)	11,515,583
Sky Contest Club (YU)	10,555,088
Belarus Contest Club	9,892,189
Kiev Contest Group	9,496,486
Lyon DX Gang(F)	9,239,910
Mariana DX Assn	8,790,719
Araucaria DX Group (PY5)	8,686,885
Shakhan Contest Club (RA6)	8,629,329
Radio Luxembourg	6,560,876
Z30M Contest Team	6,399,532
Pacific Rim Contest Club (VK4)	6,380,401
Western Siberia DX Club	6,231,697
Lichfield ARS	4,689,516
GADX (LU)	4,621,066
Sao Paulo Contest Group	4,591,158
Vologda Radio Club (RA1)	4,136,931
British Columbia DXC	3,806,311
LU4AA Club	3,744,718
GACW (LU)	3,600,502
Koryazhma-DX-Company (UA1O)	3,267,274
HA DX Club	3,104,038
Ivanovo DX Club (UA3)	2803337
ALRS (UA1)	2,716,081
SP Contest Club	2,703,865
Capital Region DXC Club (VE3)	2,631,064
Central Siberia DX Club	2,331,249
Venezuela DX Club	2,290,630
North Patagonia DX Group (LU)	1,882,823
YO DX Club	1,838,130
LZ4KAC Club	1,790,082
Saravejo Contest Group	1,643,445
LZ Contest Club	1,552,468
Fox Contest Club (YU)	1,504,447
UT4UWT Club	1,314,369
Amsterdam DX Club	1,222,783
Far East Islands DX Club (UAØ)	1,195,250
Ferrara DX Team	1,129,754
Obninsk "QRU" Club (RA3X)	1,081,224
Noviomagnum (PAØ)	1,054,129
Radio Am. As. Western Greece	1,014,195
Activity Group Belarus	905,161
YU DX Club	646,699
Tallinn Radio Club	583,897
NOL (ON)	582,035
Guara DX Group	555,869
Scout Club "Spid" (SP5ZDH)	450,893
ARM (ER)	253,433
YV Dxperts	213611
K DX Group (PY5)	180,869

USA QRM

Personal best here. Congratulations to all the participants on their fine efforts. Great to hear more participants from Asia. Highlight being called by XV7SW on 15m...***AA4S.*** The contest was a lot of fun as usual. I picked up some new ones

and turned in a better score than last year. Thanks to all for the great contest!...***AA8UP.*** Thanks for a fun contest. I operated QRP with my old Ten- Tec Triton IV at 5 watts out. My antenna is a 105 ft. dipole at 35 ft. center fed with window line. Worked several new countries. I was surprised how easy it was to work DX on 40 meters!...***AB8DF.*** I did double my QSOs from last year and 2.5 times the score, so quite an improvement from last year!...***K1EC.*** We decided to do a multi-single only about ten days before the contest and it worked! Only had to climb the tower at midnight twice to repair a trap in the tribander. Relatively warm weather (0 degrees C) made it easy!...***K1IR.*** This was my personal best effort for the CQ WW CW. Condx were excellent. 10m was hot as a pistol. This is the best fun you can have with your headsets on...***K1RC.*** First single op in years. Great conditions meant that there was plenty to do, even with low antennas and 100W...***K1RO.*** Excuse: Wish I could think of one! Prepared more for this contest than perhaps any other, but still couldn't get a good run going. Did well in the pile-ups though, and mults were well up on last year. Congrats as always to the winners and I just hope to make the top ten!...***K1VR.*** What great conditions and lotsa fun. The only way to describe 10m was *hot!* Great to hear the rare ones answering my CQ's too! This will be a contest to remember!..***K2NV.*** Many thanks to K2DM and K3PP for replacing our rotator on very short notice. Without them, the K3PH score would have been *zero*...***K3PH.***

Great conditions on 10m to Asia for a change. Limited time to operate, but enjoyed contest...***K4LQ.*** The CQ WW CW is *the* contest!...***K4RO.*** Decent condx Friday night. Saturday night was different story, however. The propagation gods decided to make things very difficult indeed. Signals from Europe were way down (at least 20 dB) from the same time Friday. This took all the 100W EU stations out of the picture. I figure 4 or 5 hours (abt 300 QSOs) worth of EU running were lost. I've come to the conclusion that there *is* no consistency to the propagation on 40m from one contest to the next (not a big surprise)...***K7EM.*** Thanks to Bob, NX5M, for use of his fine setup. I had a blast with the stacked 10m tower. Great conditions. Very surprised that I never heard V26K. Opening the contest with 9M6AAC already in the log at 00:01 was a good sign. Surprised how early 10m opened to Africa (30 min. before sunrise) and also surprised how fast it closed down totally (1 hour after sunset and the switch went off)...***K8EP/5.*** Great contest! Nice to work 100 countries on three bands. Once again, the "contest of the year"...***K8GL.*** I was portable at my Florida QTH for this contest. Much better propagation than "back home in Indiana"...***K9BG/4.*** Amazing what a few sunspots can do!...***K9MA.*** Great fun, and very pleased with my score considering my limited antenna. It was also nice to see most stations took account of the slower Morse senders. Amateur radio at its best!...***KB3EHY.*** I didn't know that you could work DX on 40 with a wire in the backyard. Yahoo!...***KC8FXR.*** Had a great time. 10m was awesome. Doing search & pounce it took me 2 hours to go from the top of the band to the bottom from all the DX!...***KC9TV.***

Nearly worked 5BDXCC in a weekend; just missed on 80, single op. Best score ever...***KF2O.*** Best experience: a wide open 15m and holding a run there for an hour. Second best was being ready to give up with ten minutes to go on 40 CW, then finding five more mults in the last ten minutes of the contest, *way* high in the band! Worst: Having to delete my only QSO with JT1 because he could not get my call ...***KJ9C.*** Wow! Saturday AM saw the rate meter over 100 doing S&P...***KM2L.*** In 1997 I operated with my old callsign, KG7XC (and even had my photo in *CQ* magazine!). This year several factors produced a score almost four times greater than 1997. First, the conditions were fantastic! Then, my "new" callsign, KN7Y, is much shorter than KG7XC, and I tried to be more efficient with the exchange. My new antenna is about 15 to 20 feet higher than the one I used two years ago at my dad's home. Also, I used Write Log for the first time in a contest, and think it is great...***KN7Y.*** Great contest. The echo on 10 meters made it easy to tell USA ops from the DX...***KW4DA.*** This contest reminded me of ice fishing—looking into the hole, jigging the line, and waiting for a big one to bite! Fishing better Saturday than Sunday. Biggest thrill: listening to the operator of TI1C copy complete callsigns at such speed...nice job! Great contest...***NØRA.*** Personal best, first time over 1 million as single op (any contest!)...***N1AO.*** Lots of contacts, Lots of fun, Little sleep!...***N2NU.*** This was my first serious single op effort in the CQ WW Contest in over 25 years. I had a blast, but just can't stay up long enough to compete with the younger guys, much less use two radios at one time! Congrats to Charlie, K3WW, for a super effort in the SOA category!...***N3RS.*** Wow! Yes, 10 and 15 were terrific, but this was also the first time I've been able to really run on 40...***N4GN.***

What can I say? This was the best of the best. My best in my over 50 years in the hobby. It was one for the ages. You didn't need 1500W and a stack to run 'em this year. This is my favorite test and I can't wait until next year...***N4MO.*** First time to break 1,000,000 on CW! The XMatch™ antenna tuners are working magically! Not bad with some sleep...***N4XM.*** Wow! My momma always told me that if I was good and saved my pennies, one day I would get to operate the CQ WW CW at a sunspot maximum with decent antennas, and it would be *fun!* It was...***N4ZR/8.*** When cndx are good 10 is a low power station's dream! Operated from my parent's old home where I made my first Novice contact almost 45 years ago...***N5AW.*** The multipliers and cndx were incredible—A61AJ, XU7AAV, SU9ZZ, HZ1AB, A45XR, etc. Wow, what a treat!...***N6AR/4.*** We dedicate our score to the memory of Bill Adams, W6BA...***N6AW.*** Had a super time. Great cndx. Beat my last year's claimed score by 33%. Working VK and KH6 one hour before sunrise on 160! The 80m phased array is very quiet compared to the dipole!... ***N6RFM/1.*** Best 10 and 15m openings I have heard in a long time. Not as many cases of automatic CQ's being used to hold frequencies as usual...***N8LM.*** Almost made DXCC with QRP on 10m. Awesome condx!...***N9CIQ.*** Great radio weekend. I concentrated on the mults. Bands either didn't close or closed very late. Like having a nickel to spend in a huge candy store. With all the opportunities I ended up S & P the whole time...***ND5S/8.*** My personal best in CQ WW CW. I operated 30 hrs. Wish I had stamina for a full 48...***NX7K.*** Great cndx to both Europe and Asia. Colorado was a good DX contest location for a change!...***WØTM.*** Ten meters was great. Every one that I could hear could hear me! Almost made my goal of 100 countries (well, 95 is close)...***W3CP.***

Contest not for 90 yr. olds...***W3EVW*** *(FB job!...ed.).* Decided to try single band 40m since I could be on at night. I was influenced by the great signal reports I got out of Europe with the beam and 700W over all this ocean in my front yard. QRN on 40 was tough late Saturday night. And the JA's are great ops! Path to SW Florida is pretty slim on 40, but they stayed with me to get the calls correct...***W4ZW.*** First time as a guest op. W6EEN's 40m antenna is a killer. The JA run begins on 40m at W6EEN when you point the antenna at JA!...***W6EEN (K6LA).*** 10m was great fun again, even from out west. As usual, I had trouble getting enough QSOs due to instinctive desire to maximize multipliers instead. What was lost in score was made up in fun...hunting while running, made possible by the stereo in the FT-1000D and a rotary dipole on the same mast, broadside to the Yagi, switched or phased as needed ...***W6YA.*** Wow, what a difference a Yagi and great band conditions make! I just put up new Force 12 Yagi (in place of my G5RV) two days before CQ WW SSB, so this is my second contest with antenna I can point! I doubled my score over 1998 with the same operating time! 10m was unbelievable!! Thanks for sponsoring the best contest going! Us little pistols count the

same number of points as the big US KW to the foreign big gun stations. Often a contest like this is my best chance to work many of these countries... ***W8VE.*** My interest is DX but I think I got bit by the contest bug and perhaps next year I'll submit as a contestant. Thanks for bringing the DX to the air... ***WO6M.*** Conditions were great! I know there will be many scores higher than this, but it's the best I've ever done in this contest, and it was *fun!*... ***WO7Y.***

Station Operators Multi-Op Single Transmitter

3A/WØYR & HA5JI, VA3EU, K6CT. **4K7Z:** 4K5D, 4K6GF, 4K5CW, 4J9NM. **4U1VIC:** DL5RMH, DL6NCY, DL6RDR, DL8NSB. **6D2X:** K5TSQ, N5RZ, AA6RX, W5VX, K5TR, XE2XDX, XE2YNE, XE2YNS. **6Y3A:** KN5H, KB3EHU. **8P9Z:** K4BAI, N4TO, K1TO. **9A1CIG:** 9A5DI, 9A5P. **9A1CMS:** 9A5TR, 9A5RJ, 9A5AVW. **9A7A:** 9A7V, 9A8A, 9A3TR, 9A4PA, 9A4RX, 9A6DM. **9A7P:** 9A6NHH, 9A5AEI, 9A6NPM. **9M6AAC:** N2OO, N4PN, K8MR, G4MJS, YBØUS. **AA1ON &** W1RH. **AA2FB &** K2QMF. **AD4ES &** K9ES. **AD7U &** N6HR. **AH2R:** JG3RPL/N1BJ, JI3ERV/NH2C, KH2/JHØUSD, JR7OMD/WI3O. **B4R:** BA4RC, BA4TB, BD5RV, BA4RX. **BY1PK:** Club. **C6AJX:** K7AR, N7NU, WJ7R, W7RR. **CE3F:** CE3FIP, SM3SGP. **CX5O:** CX1JJ, CX1JK, CX1JM, CX3JE, CX9JF. **DFØAT:** DF6QV, DJ8CR, DL9NC. **DFØCI:** DL8AKI, DL5ZL, DL1AWM. **DF1LX &** DF5JT, DL7ANR, DL7YS. **DJ5CL &** DL7MAE. **DKØFFO:** DL7UGN, DL2BWM, DL1BZA. **DKØRE:** DL1YMA, DL2YMR, DL3YGT. **DKØTZ:** DL1SBF, DL4ML, DF5EN. **DK1II &** DJ7MG. **DK6WL &** DL2NBU, DL4RDJ, DL6RAI. **DL1QW &** DF6VP, DF8QB. **DL4SDX &** DL4SDW, DL5SEJ, DL8SCG. **EA5BY &** EA5ABE, EA5BXT, EA5EU, EA5FID, EA5FXX, EA5GRV, EA5KW, EA5SM. **EA5CW &** EA5DWS, EA5AFP, EA5DFX. **EA6IB:** EA3AIR, EA3AJW, EA3GGO, EA3KU, EA5BM, EA5ZF, EA6ACC, EA6FB. **EM4E:** UR3EZ, UR5ECW, UR5EDX, UR5EFJ, USE-699. **EN5J:** UU1JA, UU2JQ, UUØJX. **ES5Q:** ES5MC, ES5MG, ES2NA, ES5QA, ES5QX, ES5RN, ES5RW, ES5RY, ES4TG. **F5SSG &** F6EXV, F5OZF. **F6KRK:** F8CRH, F6DLN, F8CIW, F4UPG, F1SXC, SWL Jozef. **F8KHZ:** F6GQO, F8BNV, F5JU, F6BCQ, F6GKQ.

GM6NX: GM3YTS, GM4UYE, GM4FDM, GM4DGT, GMØAZC, GMØKWL, GMØBWR, GMØKMD, GMØRLZ, MMØBSM. **HBØ/HB9LF:** Club. **HB7OGR:** HB9AAQ, HB9DOT, HB9HAW, HB9LCW. **HSØAC:** HSØ/G3NOM, HSØ/SM5DYU, HSØ/OH4MFA, HSØ/JR5XPG, HSØ/JA4RWN, HSØGBI, HS6NDK, E21EIC, E21CJN. **II1R:** I1NVU, IK1FXX, IK1LWL, IK1QBT. **II2K:** IZ2AVK, IK2UCK, I2ELJ, IK2BUF. **IO2A:** IK2HKT, I2IFT, IK2CIO, IK2AHB, IK2ANI. **IO2L:** IZ2ACZ, IZ2DAY, I2BJS. **IQ4A:** I4VEQ, I4IND, I4EAT, I4IKW, I4TJE, IK4DCT, IK4EWK, IK4 XQH, IK4MGP, IK2NCJ, IK2JUB, IZ4BOY. **IR1S:** I1ANP, I1AND, IK1UVQ, IW1PDP. **IR4T:** IK2QEI, I2VXJ, IK4UPB, IK4MTF, IZ2AAJ. **JA1YPA:** JA1PEJ, JH1FDP, JK1RPC, JM1NKT. **JA1ZLO:** 7L1ETP, 7L3CQP, 7N2GHD, 7N3PZJ, JM3CRK, JM4WKT, JM7WXN, JK8CHX, Yasushi Hashimoto. **JA2ZJW:** JH2CMI, JL2ICO, JE2PCY. **JA6ZLI:** JG6POJ, JJ6WYS. **JA7YAA:** Nakagawa, 7M1JAS, JM1QPR, JG7PSJ, JHØNZN, JHØORW, JE7HLZ. **JA9YBA:** H. Nada, JR9QNJ, JFØEGG. **JE4VVM &** JG4CLV, JH4UHW, JN4FEU. **JF2SKV &** JE6MYI. **JH7PKU &** JA9SSY, JO1BMV, JQ1UKK. **JI2KVW &** JI3JGJ, JQ2KAE, JF2FIU, JF2AII. **JK6SEW &** JH6QIL, JR6GKT, JI6BRB, JM6CIP. **K1GW &** W6PH, KB1T. **K1IR &** K1LZ, W1VE, KM2P. **K1KI &** K1CC, KM1P, K5ZD, W1RM. **K2SB &** WM2H. **K3PH &** W3MF. **K4OJ &** N4KM, NA8V, AJ4Y, K7JA, KL7MF, K1KNQ, W1CW, W1YL. **K6ZM:** WA6O, K6WG. **K8AZ &** K8NZ, W8CAR, W8GN, W8KIC, WT8C, N8TR. **K8LX &** N8EA, WA8ZDT. **K9BF &** NO9Z, NK1K, KX9X, W9SZ.

K9LA & K9UWA, KR9U, K5ZG, KC9LA, N9RE, AA9DZ, N9NO, W9HLY. **KG6OK &** N6HC, W1HIJ, AA6PW, KQ6ES, KI6X. **KJØG &** NØZA. **LA1K:** LA8UGA, LB7JE, LA7UJA, LA3SKA. **LA8W:** LA4DCA, LA5KO, LA8SDA, LA9HW, LA9VDA. **LA9GX &** LA6YEA, LA5UF. **LX9DIG:** DK4WD, DL2JRM, DL5SE. **LY2OM &** LY2BUU, LY2TX. **LY3AV:** LY1CX, LY1CQ, LY3BP. **LZ1ABC &** LZ1AQ. **NØAV &** KØRX. **N1AU &** WC1D. **N1TB &** AB1BX. **N2LBR &** N2LBR, WA1KKM. **N2NU &** W2REH, WW2Y, K2WI, N2RM. **N2SS &** N2MT. **N4AF &** K2AV. **N4RV &** KT4W. **N5KB &** KK7JS. **NE3F &** K3ATO, KS3F, K3XP. **NH7A &** KH6TO, AJ6V, W6EU. **OD5/OK1MU &** OK1CW, OK1TN. **OE1W:** OE1DMU, OE1JNB, OE1TKW. **OHØR:** DL1EFD, DL3KDV, OH2TA, OH8SR. **OH1F:** OH1MDR, OH1MM, OH1NOA, OH1LUZ. **OH6K:** OH6KSR, ex-OH6NU. **OH7M:** OH6LNI, OH7MS, OH7MHL, OH7KD, OH7KIR. **OK1KAO:** Club. **OK1KCF:** OK1KZ, OK2-5485. **OK1RR &** OK8ANM, OK1FLM. **OK2KDS:** OK2VWB, OK2HIJ, OK2-22266. **OK2KOD:** OK2BNX, OK2BJ. **OK5W:** OK1AEZ, OK1CF, OK1WF, OK1FKD, OK1DDO, OK1JR, OK1JKT. **OL5DX:** OK2-5485, OK1KZ. **OL5Q:** OK1FLC, OK1FFU, OK1VSL, OK1AYE. **OM3A:** OM3DX, OM3CGN, OM8AM, OM8AU, OM8AW, OM8DM, OMØWR. **OM3KZA:** OM3TPN, OM6FN, OM3YDX. **OM5M:** OM1KM, OM2RA, OM2KI, OM3BH, OM3LZ, OM3RG, OM6NM, OM3EI, OM3GB. **OM7M:** OK2BFN, OM2XW, OM3PA, OM3PC, OM3TZQ, OM5RM, OM5ZW. **OM8A:** OM1BM, OM2VL, OM3RM, OM3EA, OM3NA, OM3GI, OM3CW, OM7JG. **OT9P:** ON6AH, ON6MH, ON6QR, ON6VL, ON7PC, ON5AV.

OZ/DJ9RR & DL8HCO, DK3LT, DL1HCM, DJ7LX. **OZ5WO &** OZ1BIZ, OZ3ZW, OZ5WO. **P3A:** RA9JX, UA3DPX, RZ9UA, RW3TJ, UA3TU, UT7QF, 5B4AGM, RZ3AS. **PI4CC:** PA3BAG, PA3EPD, PA3BSQ, PBØAIU, DL GUEST. **PI4DEC:** PA3AAM, PA3HFR, PD3FVK. **PY3MHZ:** PU3AGP, PY3AFS, PY3BZA, PY3MRZ, PY3TMR. **R1ANF:** UA1PBA, UA1PAW. **RA9ST &** RA9SG. **RF9C:** RZ9CO, RA9CMO, UA9CDC, UA9AR, UA9FQY, UA9CIR, UA9CRO, UA9FMZ. **RK3QWM:** RA3OU, RW3QJ, RV3QM. **RK3UWA:** RV3UG, RA3UC, UA3UAW, Igor, UA3-123-444. **RK4FWX:** UA4FCV, UA4FAR, RK4FB, RK4FD, RW4FO. **RK6AYN:** UA6AH, RW6ACM, RN6BP, RZ6AHE. **RK9KWI:** UA9KJ, RA9KM. **RK9SWF:** RA9SG, RA9ST. **RK9TWA:** UA9SBM, UA9SBC. **RU1A:** RW1AC, RV1AW, RU1AA, RX1AA, RA1ARZ, RA1ARJ, UA1ACC, RN1AM. **RW3WWW:** Club. **RW4LYL:** RA4LW, RN4LP, RU4HP, RW4HW, RW4LE, UA4LU, UA4LY. **RZ1AWO:** UA1AAF, UA1AQF, R1A-. **S52OP:** S57XZ, S52SK, S51NM, S51MA, S53DS, S52OP. **S92CW:** DA1MH/KAØKKO, DK5AX/K2AXS. **SK3W:** SM3EVR, SM5IMO, SM5TXT, SMØAJU, SMØOEK. **SP1PEA:** SP1NY, SP1NQF. **SP1PLA:** SP1MHV, SQ1FTB. **SP3KFH:** SP3ASN, SP3GTS, SP3JZR. **SP9KRT:** Club. **T32PO:** N5PO/T32PO, T32BO/N5RG, T32BE/WC5P.

TI5N: K4UEE, TI2WGO, K9VV. **TM2Y:** F6BEE, F6ARC, F6FGZ, F6FVY, F5NLY, F9IE. **UA7A:** RN9AO, RU9AN, RU9AZ, RW9MG, RZ9AZ, UA9AJ, UA9BA, UN7LCG, UN7LEB. **UR4LWY:** UR5LJC, UR4LQA, UR3LDJL. **UR4MWU:** UR4MEU, UR5MA, UR5MB, URØMM. **UT7L:** UR4LRG, UR4LTX, UR4QKD/A, US4LGW, UY5LW. **UT7Z:** UR5ZJL, UR7ZZ, US5ZZ, UT4ZO, UTØZZ, UY2ZA, UYØZG. **UU5J:** UU2JQ, UUØJX. **VE3EJ &** G4VXE, VA7RR, VE2ZP, VE7ZO. **VE5FN &** VE5FF, VE5FR, VE5WI, VE6EWM, VE6EZ. **VE6AO:** VE6LB, VE6TC, VE6KC, VE6CIZ. **VO2WL:** VE1BJW, K3TM. **VP5DX:** N4KE, NU4Y. **W1HR:** W1JCC, W1MD. **W1NR &** W1BK. **W2AA:** N2TX, W2XX, N9KAU, NY6DX. **W3LJ &** K3NCO. **W4PRO &** WB4DNL, AF4CD. **W6YX:** W6KNS, W6LD, N7MH. **W7VJ &** AA7CQ. **W8ZA &** K8OQL, N8II. **WA2UBK &** N2WKS. **WB9ZEZ &** W9CG. **WN9O &** W9IU, K9FN, WB9QPG. **WXØB/5 &** NM5M, W5GN, K5GA, N5NU, K5SL. **WX3B &** N3SB. **WY3T &** N3JRX. **YB3ZES:** YD3BMB, YD3TYO, YD3TWZ, YD3BHR. **YL4U:** YL2KL, YL3DW, LY1FF, LY3NFW, YL2KA, YL2MD, YL2GQT. **YO5KAD:** YO5PBG, YO5OHY. **YO8KOS:** YO8AXP, YO3JJ. **YT1Z:** YT1WN, YU1YR, YU1YM, Sanja, Kicha. **YU1AOI:** YU1AR, YU1SK. **YU1INO:** YZ1DQ, YU1EK, YU1RS252. **YZ7A:** YU7CM, YU7KC, Lacy, Tibi, Zola. **Z3ØM:** Z31GX, Z31JA, Z31GB, Z32XX, Z32KO. **ZA/S51F &** S57AW. **ZC4AKR:** 5B4AGC, 5B4AFB, G3VMW, G3ZEM, ZC4OS, ZC4CM. **ZF2AM:** K6AM, W6VNR, W5ASP. **ZM2K:** G4EDG, ZL2AZ, ZL2AGY, ZL2DX, ZL2BSJ.

Station Operators Multi-Op Multi-Transmitter

4M7X: K2KW, N6BT, N6TV, N6BV, W4SO, NT1N, AG9A, K9ZO, KE7X, WA5VGI, Bonnie. **4U1ITU:** K1TW, K2BHX. **9G5AA:** 9H1EL, G3SXW, G3XTT, G4BWP, G4PIQ, KC7V, KF7E. **A61AJ &** K1ZM, K3RA, KE3Q, N6ZZ, PA4AO, T93M, T93Y, T97M, WØUN, W3UR. **CN8WW:** DJ2QV, DK1BT, DK2OY, DK8LV, DK9IP, DL2MEH, DL3DXX, DL3NCI, DL6FBL, DL6LAU, DL8WPX, S51TA. **DFØHQ:** DK7YY, DL1AUZ, DL2OBF, DL3OI, DL3TD, DL4MM, DL5ANT, DL5AXX, DL5LYM, DL7URH, DL7VOA, DL7ZZ, DL8WAA. **DLØKF:** DJ7SW, DJ4FZ, DJ6TK, DL3LBX, DL4LBK, DL5XJ, DF3LZ, DL8PY, DF4PA, DJ3UL, DL3LAR. **EA4ML:** EA1DAV, EA2KV, EA4AMO, EA4BPJ, EA4DRV, EA4ET, EA4KA, EA4MC, EA4TX, EA7KN. **EA4RCV:** Club. **EA9EA:** EA1AK, EA4KR, EA7TL, EA7KW, EA7GTF, EA7GYS, EA7TH, EA9AZ, EA9AI, EA9EU. **EU5F:** EU6DX, EW6AF, EU6MM, EW6AW, EU6TV, EW6BI, Andrei. **GM7V:** GM3WOJ, GM4YXI, GMØNAI, GMØGAV, GM4CXM, GM3YOR. **HG6N:** HA5TI, HA6DX, HA6OY, HA6OB, HA6ON, HA6OI, HA6ND, HA6NF, HA6NL, HA6NY, HA6PX. **J3A:** AL7NC/JK3GAD, K2KQ, K2TE, K5TT, NJ1V, WA1S. **J45T:** SV5TH, SV5DZS, SV5FRD, SV5FRK, SV5/KB4PMS, G4OBK, G4RCG, OM5RW. **JA3YKC:** JP3PZD, JL4CVB, JE5DTS, JP6RBN, H. Sugiyama. **JA3ZOH:** JH3PRR, JE3MAS, JG3KIV, JI3OPA, JH4CES, JH4IFF, JH4NMT, JR4ISF, JF4FUF. **JA5BJC &** JA5FDJ, JA5JCC, JH5FXP, JH5RXS, JR5JAQ, JR5VHU, JM1UMB, JS1OYN. **JT1JA:** JT1CO, JT1BV, JT1BJ, JT1BL, JT1AA, JT1BH, JT1CD, JT1DA. **KØRF &** KØAV, KØEU, NØHF, W1XE, WØUA, WBØGAZ.

K1RX & KF1V, AA1SI, W1FJ, W3SM, K1EPJ. **K1TTT &** K1TWF, K1MK, WO1N, W1ES, K1WD, KB1W, NT2X, KC2FEE, NT2A, W2WB, WR2I. **K2LE/1 &** K2UU, N2GA, N2QW, N2UN, W1MA, W2AX, W2LK. **K3II &** K3VA, K3CT. **K3LR &** W3GH, W2RQ, AA4NC, W4PA, NI3S, K3UA, N3RA, N3GJ, W9KNI. **K4VX/Ø &** K2VV, K5GO, N5DX, N5OE, K5LG, KM5G, K9BGL, N9JF. **K8CC &** AC8W, K8DD, K8GT, K8JM, K8MM, NU8Z, W8MJ, WD8S, WX3M. **K9NS &** AA9D, K9DX, K9GS, K9HMB, K9JY, K9PPY, K9PW, K9QVB, K9RS, KS9U, N9CO, N9FH, WV9T. **KB1H &** NB1U, K1EBY, N1XS. **KC1XX &** AD1C, K1EA, W1FV, K1GQ, N2IC, N3RD, KM3T, K6AW, DL7SI. **KL7Y &** WL7E, KL7FH, KL5E, KL9A, WA2GO, KK7GW, KL7XX. **LY7A:** LYR346, LY2AO, LY2OC, LY2HK, LY3DA, LY3BAD, LY3HD, LY2FN, LY2BMX, LY2UF, LY1EE, LY4AA, LY2NK, LY2KZ. **M4T:** GØVQR, G4ELY, GØLHZ. **N1RR &** WM1K. **N2BIM &** K2BM, WB2BHC. **N3AD &** WF3H, WQ3E. **N6AW &** N6MJ, W6KK, N6WS, N6VR, W6GA, K6HMS. **NM3K &** AA2D. **NR4M &** K4EU, K7SV, WA4JUK, K1SE, K4GMH, K4EC. **OH2U:** OH2BVI, OH2FT, OH2HE, OH2IW, OH2JQS, OH2JTE, OH2LUR/ES2RR, OH2MAM, OH2XX, OH4YR, OH6CT, OH7BX, OH7JR, OH8KXK. **OL7W:** OK1DUT, OK1FDR, OK1FUT, OK1TA, OK1VBA.

OZ5W: OZ1FTU, OZ3W, OZ9Y. **PI4COM:** PA1AW, PA1AG, PA3CAL, PA3BWD, PA3EWP, PA3FQA, PA3FVZ PA4EA, PA5AT, PA5ET, PA7SM. **PJ4B:** K1XX, K2SS, K3EST, K9PG, N2AA, N2NC, N3ED, N6IG, N6RT, KL2A, W3UM, N7BG, WA3LRO. **RS3A:** Club. **RW2F:** RA2FA, RA2FBC, RN2FA, RA6CO, UA2FB, UA2FC, UA2FF, UA2FJ, UA2FZ, UA9CDV. **SM5HJZ &** SMØGNS. **UX8IXX:** US8IDX, UA9JKL, US8IBS, UX8IX, US8ILZ, Ivan, Igor, Eugen, Nick, Alex. **V26K:** AA3B, K3TEJ. **VE2CQ:** VE2NZR, VE2GDA, VE2KDC, VE2ZWA, VE2ETR, VE2SG. **VE5RI:** VE5FF, VE5FN, VE5FR, VE5WI, VE6EWM, VE6EZ. **VQ9IO:** VQ9CV/ND1V, VQ9DX/ AA5DX, VQ9PO/ W3PO, Dale. **WØAIH/9 &** KMØO, WAØRBW, NE9U, WØUC, K9WIE, K9AY, KØTG, WRØDK, KTØR. **W1QK &** W1QJ, N1GS. **W2CG &** W2NO, K2WJ, KB5U. **W3EA &** W8FJ, K3OX, W3CF, WT3Q. **W3LPL &** W2GG, ND3A, K3LP, AI3M, K3MM, N3OC, K3RV, WR3Z, KD4D. **W3MM &** W2YC. **W3PP &** N6ZO, AA1K, NW3Y, WB4FDT, N3HUV, KT4P, K3FT, KW3Z, NX3A. **W4MYA &** K4GAU, K4WMA, NØNM (3DAØCA), W4HJ, W4HZ, WA4QDM, WK4Y, WU4G. **W6OAT &** AI6V. **W7RM &** NØAX, N7OU, NW7DX, JR1NKN, K9JF, KI7Y, K5ZM, K7JOE, N7ATM, W7WA, W7BX, K7NT. **W8AV &** K3JT, K4LT, AF8A, KU8E, N8DCJ, W8RZ, W8WTS, WØCG. **WU3M &** N3MKZ. **ZP6T:** N3BNA, AB2E, CX6VM, ZP5MAL, ZP5AZL, ZP5WBM, ZP5VAY.

Number groups after call letters denote following: Band (A = all), Final Score, Number of QSOs, Zones, and Countries. An asterisk (*) before a call indicates low power. Certificate winners are listed in bold. (All country terminology reflects the DXCC list at the time of the contest.)

CW RESULTS
SINGLE OPERATOR
NORTH AMERICA
UNITED STATES

K1AR	**A**	**8,046,695**	**4177**	**166**	**519**
W1KM	**"**	**7,583,360**	**4019**	**165**	**491**
K1ZZ	**"**	**7,099,542**	**3777**	**158**	**499**
K5ZD/1	**"**	**6,570,312**	**3935**	**152**	**452**
				(Op: W2SC)	
KQ2M/1	**"**	**6,500,892**	**3671**	**161**	**481**
K1DG	**"**	**5,942,552**	**3535**	**150**	**466**
W1WEF	**"**	**5,718,249**	**3407**	**152**	**451**
KC1F	"	4,461,360	2726	145	435
WC1M	"	3,725,384	2900	119	333
K1YT	"	2,377,998	1502	140	427
KS1L	"	2,010,680	1117	150	518
W1ECT	"	1,988,231	1709	103	336
W1TE	"	1,929,080	1230	145	435
W1NT	"	1,326,312	1123	123	384
W1AX	"	1,050,112	875	119	329
W1JR	"	879,814	653	120	374
NQ1K	"	740,544	600	120	344
W1WFZ	"	639,744	677	90	267
W1ZS	"	547,785	664	83	232
KE1FO	"	443,408	679	62	197
K1LU	"	389,025	521	81	234
N1DS	"	329,622	480	67	207
K1BV	"	286,436	481	54	148
W1LLU	"	265,437	429	73	188
K1DWQ	"	233,172	395	64	190
W1OHM	"	215,760	345	73	175
WQ1H	"	130,816	233	59	165
W1AZ	"	103,917	209	56	145
K1MV	"	61,456	181	51	133
W1CC	"	52,000	146	36	124
N1RC	"	22,098	133	37	90
WR1P	"	16,744	83	32	59
KK1L	"	4,830	51	11	35
KE1GQ	"	2,546	27	16	22
K1RM	**28**	**789,330**	**1689**	**35**	**131**
WA1FCN	"	150,000	492	29	96
W3EP/1	"	138,303	462	32	95
KR1G	**7**	**515,460**	**1326**	**33**	**109**
W1MK	**3.5**	**346,332**	**1031**	**29**	**95**
K2LP/1	"	12,096	92	10	46
K1VW	**1.8**	**12,696**	**141**	**21**	**48**
***K1RO**	**A**	**3,021,344**	**2047**	**120**	**406**
***K1VUT**	**"**	**2,555,175**	**1809**	**131**	**394**
***KM1X**	**"**	**2,256,638**	**1685**	**116**	**362**
***K1VR**	**"**	**2,142,112**	**1585**	**123**	**388**
				(Op: W3EF)	
***KB1EAX**	**"**	**2,075,532**	**1569**	**133**	**381**
***K1NO**	**"**	**1,710,912**	**1415**	**115**	**341**
				(Op: K5FUV)	
*W1EQ	"	1,645,440	1250	113	367
*K1HT	"	1,431,792	1074	124	364
*N1GF	"	1,369,669	1011	121	382
*K2AZ/1	"	1,252,774	909	131	440
*WØMHK/1	"	1,225,962	1052	113	338
*W1ZK	"	1,152,884	938	118	348
*NM1W	"	917,472	733	108	348
*AE1B	"	885,115	859	108	277
*KA1IS	"	770,408	856	104	320
*K1GU	"	700,362	733	82	287
*W1KT	"	689,605	609	109	318
*NY1S	"	629,180	711	80	246
*K1VSJ	"	544,258	578	102	244
*N1HOQ	"	534,087	511	96	297
*W3TB/1	"	463,740	528	91	263
*N3KCJ/1	"	293,584	401	66	192
*K2MN/1	"	256,464	330	78	196
*W1ZZ	"	163,615	270	63	152
*N1EDM	"	148,016	305	62	170
*K1EC	"	140,400	293	63	162
*AA1SU	"	69,275	217	51	112
*K1EP	"	61,420	177	43	105
*NØICI/1	"	24,960	117	23	57
*WA1WFH	"	100	89	35	62
***W1PL**	**28**	**88,508**	**313**	**26**	**78**
***K1PX**	**1.8**	**2,628**	**32**	**15**	**21**
N2LT	**A**	**5,490,882**	**3119**	**156**	**465**
K2UA	**"**	**4,921,488**	**3132**	**137**	**435**
W2LC	**"**	**3,912,925**	**2515**	**132**	**425**
N2NT	"	3,046,749	2305	115	346
N2CU	"	2,952,638	1885	145	414
K2NV	"	2,731,082	1871	132	389
W2EN	"	2,640,949	1799	130	391
K2FU	"	1,614,010	1193	132	383
W2ZU	"	1,524,024	1089	111	377
K2SIG	"	1,522,267	1235	111	346
WA2VYA	"	1,323,477	1005	132	347
KW2J	"	1,075,832	1055	91	265
AE2F	"	999,878	722	128	389
K2UOP	"	869,820	833	108	312
WA2VZQ	"	646,758	683	79	275
N7UN/2	"	617,400	619	103	317
N2MR	"	600,607	635	103	256
W2YK	"	586,560	629	102	288
KE2WY	"	502,000	707	109	291
WA2YSJ	"	478,559	461	105	268
NA2M	"	404,482	443	98	233
KB2NMV	"	398,976	505	102	282
K2UF	"	373,644	451	93	228
W2SF	"	330,660	426	87	247
NC1A/2	"	301,264	425	83	221
NW2J	"	272,904	431	57	192
W2EZ	"	221,382	423	64	187
KG2MY	"	24,738	86	37	77
K2FR	"	10,875	129	40	85
K2ZJ	**28**	**542,991**	**1356**	**33**	**108**
N2PP	**"**	**529,200**	**1384**	**33**	**107**
K2CS	"	34,365	153	23	64
N2MF	**21**	**687,357**	**1631**	**39**	**120**
K2BA	**14**	**269,920**	**641**	**37**	**123**
W2ZI	"	83,636	316	28	88
N2GC	**7**	**230,445**	**599**	**28**	**107**
N2UM	"	27,140	119	20	72
W2VO	**1.8**	**4,230**	**52**	**13**	**32**
***N2BA**	**A**	**3,347,190**	**2279**	**133**	**406**
***N1JP/2**	**"**	**1,039,224**	**807**	**121**	**395**
*KM2L	"	768,984	771	90	268
*WB2ABD	"	749,992	707	101	288
*N2RD	"	733,752	819	100	287
*K2ZR	"	514,050	560	97	248
*KA2D	"	433,411	519	88	253
*W2CVW	"	410,240	456	83	237
*WA2EYA	"	301,350	402	81	206
*W2TX	"	277,303	383	66	191
*N2LK	"	256,850	430	68	207
*WW2J	"	225,398	361	66	185
*WA2VQV	"	204,180	308	66	180
*KD2P	"	199,215	344	66	167
*W2UDT	"	171,039	387	59	154
*W2XL	"	118,174	263	40	121
*W2TZ	"	110,550	266	54	111
*W2FUI	"	79,707	174	50	63
*K2UG	"	68,996	150	61	127
				(Op: WA2JQK)	
*K2SZ	"	64,020	191	49	116
*K2SWZ	"	55,223	162	50	111
*K2CF	"	53,619	198	45	138
*K2JF	"	26,634	173	62	131
*KG2NO	"	20,116	79	42	65
*WF2B	"	957	20	16	17
***K2MFY**	**28**	**173,801**	**463**	**34**	**117**
***W2MMD**	**7**	**90,415**	**348**	**22**	**85**
***WB2DVU**	**"**	**83,579**	**297**	**24**	**88**
K3ZO	**A**	**5,937,057**	**3725**	**143**	**424**
W3BGN	**"**	**4,691,051**	**2720**	**161**	**456**
W3MC	**"**	**3,735,736**	**2520**	**138**	**430**
KQ3F	"	3,324,490	2425	123	355
AA3TT	"	2,574,759	2012	116	335
K2PLF/3	"	2,276,592	1632	132	384
K3ZA	"	1,022,801	1113	92	285
WF3M	"	987,712	999	85	267
W3RJ	"	927,870	988	106	288
K4JLD/3	"	914,544	695	120	344
N3KR	"	833,160	799	103	321
W3AZ	"	809,472	792	103	305
WE3E	"	747,720	969	74	261
N3OA	"	463,256	540	84	232
W3BYX	"	403,144	571	70	252
N3RJ	"	387,450	668	87	228
W2TN/3	"	381,696	508	97	239
N3MV	"	366,018	410	95	223
WA2C/3	"	300,564	519	76	200
K3MD	"	211,703	317	81	188
WT3W	"	195,822	325	78	175
K3SX	"	140,694	258	89	173
W3EH	"	114,898	239	58	145
W3EVW	"	46,720	183	41	105
KB3X	"	31,892	109	44	75
W3GN	**28**	**101,952**	**355**	**31**	**87**
W3VT	"	74,624	264	28	78
KB3A	21	14,352	120	23	55
W2FCR/3	1.8	1,722	47	14	27
***N1WR/3**	**A**	**1,329,766**	**1059**	**107**	**347**
***NY3M**	**"**	**679,497**	**707**	**100**	**299**
*W3DAD	"	504,900	595	75	231
*KE3VV	"	300,300	419	75	211
*W7LPF/3	"	286,124	364	88	219
*W3BEN	"	206,448	340	76	196
*W3KM	"	140,499	287	52	149
*W3FQE	"	92,018	229	50	89
*KB3AFT	"	69,000	160	63	121
*N8NA/3	"	55,476	146	44	94
*W3GL	"	54,614	175	47	119
*NV3V	"	6,424	62	33	55
*N3EA	"	3,055	47	20	27
***W3CP**	**28**	**107,482**	**324**	**29**	**93**
***WW3S**	**21**	**423,776**	**910**	**37**	**127**
***W3KHQ**	**14**	**55,990**	**208**	**33**	**77**
*KB3EHY	"	32,220	159	23	67
W4AN	**A**	**8,279,616**	**4301**	**175**	**521**
K4ZW	**"**	**5,479,404**	**3320**	**151**	**451**
N4AO	**"**	**4,432,022**	**2810**	**159**	**464**
W4RX	"	3,633,224	2409	146	423
W4MR	"	3,564,743	2281	133	426
				(Op: N4CW)	
K1PT/4	"	3,187,620	2248	147	393
AA4S	"	3,156,825	2213	139	386
N4GN	"	3,127,448	2114	142	387
K4AB	"	3,025,770	2163	139	380
N6AR/4	"	2,853,452	1518	166	541
K4RO	"	2,356,596	1839	130	354
K4LTA	"	1,676,530	1594	124	343
W4YE	"	1,562,652	1147	116	361
K4NO	"	1,382,040	1067	133	362
N4XM	"	1,025,545	833	131	332
W4OX	"	947,445	855	117	298
N4MM	"	849,528	681	115	322
N3JT/4	"	657,286	779	87	266
W4AU	"	630,054	753	79	227
AA4NN	"	535,952	633	84	244
K4LQ	"	442,618	492	88	253
K4VV	"	361,998	506	84	222
W4ZYT	"	353,805	440	84	225
K5VG/4	"	299,054	400	81	206
W7QF/4	"	290,360	402	79	201
WA4MSU	"	279,279	421	73	206
W4IF	"	271,816	385	67	177
N4QV	"	258,379	348	87	196
W4RW	"	186,394	302	49	165
W4KJ	"	174,768	313	80	184
K4LM	"	164,265	247	67	168
W4OV	"	161,109	333	68	175
N4UH	"	158,440	260	68	165
K4YT	"	106,817	256	75	148
W4SI	"	88,854	215	57	120
WD4JR	"	79,975	201	50	125
K4UX	"	69,164	133	73	116
K2OY/4	"	62,856	186	66	128
N3RC/4	"	43,200	131	50	100
W4TE	"	17,112	75	29	64
K4MA	"	16,948	89	29	47
WB4NRI	"	11,592	80	26	66
W4OGG	"	3,318	32	10	10
N4CU	"	100	32	18	25
K4EA	**28**	**559,680**	**1243**	**36**	**140**
N4BP	**"**	**489,839**	**1291**	**32**	**101**
K4WX	"	460,224	1224	33	103
W4XJ	"	438,354	1125	32	110
K4ZA	"	423,504	1268	34	102
W9WI/4	"	360,250	988	31	100
N4IR	"	252,166	780	28	90
K6EID/4	"	168,432	484	31	101
K4WI	"	45,276	213	25	59
				(Op: K4JYO)	
AA4GA	**21**	**690,536**	**1651**	**36**	**116**
NN4T	**"**	**633,294**	**1557**	**35**	**116**
NQ4I	**"**	**589,632**	**1361**	**38**	**128**
KS7O/4	"	492,590	1161	36	119
KT3Y/4	**7**	**695,002**	**1667**	**34**	**120**
K4XS	**"**	**687,516**	**1764**	**33**	**108**
K4AO	"	238,868	661	31	102
W4ZW	"	153,120	714	25	91
WJ9B/4	"	98,262	404	21	82
W4NTI	"	61,048	231	20	84
W4GD	3.5	14,760	82	21	61
AG4W	"	8,344	60	15	37
K4RX	**1.8**	**12,834**	**113**	**22**	**47**
K4TEA	"	12,408	78	19	47
N4UK	"	11,977	81	19	40
W4AX	"	2,210	26	14	20
***KØEJ/4**	**A**	**2,754,150**	**1951**	**141**	**384**
***WD4AHZ**	**"**	**2,177,055**	**1631**	**125**	**354**
***NA4K**	**"**	**1,617,456**	**1224**	**129**	**367**
*N4IG	"	1,031,184	861	109	325
*K4FPF	"	989,463	834	109	349
*N4PSE	"	881,156	785	106	330
*K4MX	"	819,714	737	108	298
*K4BAM	"	551,745	733	79	226
*N8LM/4	"	544,410	598	97	248
*K4IE	"	539,748	622	100	248
*N4GJ	"	288,687	508	76	157
*K4OGG	"	255,564	407	65	164
*W2YE/4	"	197,532	298	64	172
*K9BG/4	"	183,264	300	68	181
*AA4KD	"	173,888	293	71	176
*N3TG/4	"	169,280	286	65	165
*AF4OX	"	156,137	386	55	138
*W4SD	"	142,274	255	61	162
*KW4DA	"	133,984	247	66	146
*K4HC	"	123,760	234	61	147
*K6ETM/4	"	111,618	256	55	107
*K4UVT	"	102,168	172	72	144
*K2UFT/4	"	98,436	239	45	111
*KG4BIG	"	97,344	259	56	113
*K4UK	"	57,768	174	33	83
*KØCOP/4	"	55,152	299	41	103
*KZ2I/4	"	54,964	149	52	99
*AC4JI	"	42,167	174	47	102
*KF4OAD	"	41,440	138	41	99
*NX9T/4	"	32,896	121	42	86
*WB4DNL	"	32,893	100	48	79
*NZ4DX	"	26,163	168	51	120
*KE4OAR	"	160	19	16	16
*N4KN	"	100	65	27	43
***W4WA**	**28**	**298,571**	**939**	**30**	**89**
***WB4TDH**	**"**	**283,300**	**714**	**34**	**117**
***WO4O**	**"**	**245,280**	**648**	**32**	**108**
*K4FXN	"	221,904	557	34	110
*N4GM	"	186,600	447	32	118
*K4WW	"	79,825	293	28	75
*KN4Y	"	73,336	312	25	78
*N4UW	"	68,012	266	26	72
***N4MO**	**21**	**464,512**	**1104**	**34**	**118**
***KUØC/4**	**"**	**410,711**	**1049**	**38**	**123**
*K4LDR	1.8	420	13	6	9
K5MR	**A**	**3,516,792**	**2336**	**148**	**404**
K5YAA	**"**	**3,033,630**	**1993**	**143**	**412**
N5JR	"	1,533,056	1234	113	335
N5LZ	"	1,359,774	1278	124	323
K5HP	"	943,200	1037	100	260
K5ZO	"	504,084	696	107	250
WA5SOG	"	445,851	546	101	236
W5RZ	"	307,850	421	77	185
K5IUA	"	74,000	198	44	104
K5RX	**28**	**655,044**	**1425**	**38**	**131**
NA5B	**"**	**345,135**	**964**	**33**	**100**
				(Op: W5AO)	
K8EP/5	"	302,366	810	36	110
K5MU	"	197,238	574	34	108
W5ZO	"	185,415	567	34	107
KZ5MM	"	160,186	746	31	91
				(Op: W5MJ)	
N8SM/5	"	2,750	49	9	13
W5JRP	14	100	71	19	40
K5NU	**3.5**	**96,728**	**379**	**26**	**81**
NX5M	1.8	1,920	41	13	19
***WD5K**	**A**	**1,537,569**	**1108**	**135**	**366**
***K5KLA**	**"**	**965,520**	**888**	**108**	**297**
***KY5N**	**"**	**883,392**	**942**	**86**	**258**
*K5WO	"	777,188	972	95	236
*NN5T	"	420,693	526	81	218
*AF5Z	"	265,185	410	71	178
*N5XT	"	220,594	359	77	194
*KT5O	"	211,792	290	82	166
*AJ4F/5	"	163,770	317	66	140
*KØCIE/5	"	66,978	263	62	121
*N5AF	"	33,150	115	38	64
*K6XX/5	"	18,486	99	32	46
*W5					
/OH7WV	"	1,815	23	12	21
*WA8GHZ/5	"	1,785	104	36	69
*N3TNN/5	"	682	11	11	11
*KY5S	"	110	13	6	5
***N5AW**	**28**	**264,231**	**625**	**35**	**118**
***W5CWQ**	**7**	**60,480**	**211**	**28**	**84**
*K5BN	"	6,664	158	17	51
W6EEN	**A**	**4,008,744**	**2801**	**155**	**381**
				(Op: K6LA)	
N6TU	**"**	**1,833,720**	**1577**	**138**	**334**
N6CW	**"**	**1,486,706**	**1024**	**146**	**396**
W6TK	"	946,737	898	122	271
KI6T	"	926,772	765	134	328
N7FF/6	"	585,446	1004	78	179
W6KNB	"	538,248	602	109	219
N6TW	"	449,155	544	97	216
N6YEU	"	384,970	504	80	194
K6III	"	343,539	461	96	191
W6UJ	"	293,314	473	107	180
W6RFF	"	256,587	402	95	172
N6VH	"	177,240	321	88	122
WO6M	"	172,299	539	88	149
K6VNX	"	130,200	244	65	135
K6UO	"	127,624	215	70	142
WW6D	"	126,251	250	66	125
K6GT	"	124,976	231	82	132
W6GEE	"	115,619	246	71	128
KG6O	"	112,138	233	85	142
W6NKR	"	84,796	203	67	105
W6SRU	"	77,830	152	63	118
K6CSL	"	53,988	163	66	66
N6ER	"	42,075	169	42	57
W6MVW	"	41,265	156	31	74
N6OL	"	27,576	155	22	50
W6MFC	"	12,403	61	33	46
W6/KH6DX	"	7,420	153	31	39
K6RFM	"	6,016	45	21	26
W6NL	**28**	**557,100**	**1337**	**36**	**114**
W6YA	**"**	**502,150**	**1112**	**38**	**128**
AC6DD	"	255,143	801	32	95
KF6MIC	"	253,572	673	35	97
KA6BIM	"	237,300	663	34	106
W6DCC	**14**	**80,087**	**286**	**30**	**89**
K8PO/6	**7**	**387,552**	**1069**	**33**	**99**
NF6S	"	195,199	623	31	96
W7CB/6	"	153,627	537	31	92
W6RCL	"	29,492	157	23	50
K6YK	"	22,673	103	24	55
K6SE	1.8	760	24	9	10
***K6XV**	**A**	**1,177,923**	**1038**	**129**	**302**
***K6RO**	**"**	**1,106,350**	**1043**	**121**	**285**
*N6NG	"	262,474	408	90	173
*W6ZL	"	243,705	437	74	137
*AA6EE	"	199,662	341	82	132
*KF6A	"	197,877	362	67	146
*W6PLJ	"	187,497	366	89	160
*N6IBP	"	165,356	84	60	76
*N6NF	"	125,240	232	69	133
*N6JM	"	122,070	239	67	128
*K6UM	"	115,255	233	74	111
*N6GL	"	80,976	212	70	98
*K7GT/6	"	70,104	214	51	87
*AD6G	"	65,280	214	49	79
*WA2BHJ/6	"	51,256	138	68	104
*N6GG	"	34,048	92	47	81
*K6CEO	"	13,468	122	36	55
*KQ6NN	"	1,496	40	9	15
***NU6S**	**28**	**207,090**	**613**	**31**	**99**
***K6OY**	**21**	**280,176**	**687**	**38**	**118**
*AE9F/6	"	95,795	333	32	87
*WA6FGV	"	55,460	228	25	69
*KU6T	7	7,841	59	22	33
K7RAT	**A**	**3,466,386**	**2254**	**165**	**409**
W7GG	**"**	**3,381,516**	**2398**	**157**	**365**
W2VJN/7	**"**	**2,842,605**	**1879**	**157**	**386**
AA7A	"	2,750,069	1843	147	406
K4XU/7	"	2,398,914	1621	156	397
W7OM	"	1,044,151	982	131	312
KG7H	"	970,746	927	132	274
K7WP	"	903,756	852	127	279
K7BTW	"	869,910	1057	103	218
WO7Y	"	676,200	719	106	244
W7YS	"	639,232	679	109	243
K7DZ	"	613,800	598	108	252
W7UB	"	605,949	821	87	222
KS7T	"	583,098	656	94	220
W8AEF/7	"	460,010	623	97	217
W7IIT	"	455,840	506	94	202
W7QDM	"	450,240	541	106	229
K7ABV	"	427,818	533	102	237
K7NV	"	358,050	496	109	201
NE9Z/7	"	325,600	377	122	285
W7QN	"	301,513	396	94	187
W7LR	"	229,350	300	97	181
W7LGG	"	182,759	354	62	117
KC7UP	"	134,652	290	72	157
N7JXS	"	131,580	765	57	115
K7QQ	**28**	**335,512**	**951**	**33**	**103**
N4VZ/7	"	184,092	490	33	105
W7AYY	"	87,584	273	29	83
N7DD	**21**	**557,613**	**1338**	**40**	**119**
K7ZZ	"	243,171	826	30	93
WA6IQM/7	14	60,756	205	35	87
K7EM	**7**	**554,952**	**1371**	**37**	**115**
KY7M	"	97,750	300	29	86
K7XX	"	55,386	195	26	76
W3AS/7	"	2,112	22	11	21
***K7ZA**	**A**	**1,080,762**	**934**	**121**	**305**
***KN7Y**	**"**	**959,976**	**1032**	**119**	**283**
***WW7Q**	**"**	**727,560**	**693**	**115**	**272**
*AB7RW	"	389,956	550	85	181
*W7HS	"	266,560	356	101	179
*NN7A	"	71,068	168	66	97
*KN7T	"	47,725	163	50	65
*AK7O	"	37,842	318	47	72
*WA2OCG/7	"	30,537	157	44	73
*N7TL	"	29,835	139	52	65
*WO7T	"	25,419	229	43	68
*KA7FEF	"	16,348	97	29	32
*AE7EE	"	6,832	41	20	41
*K7TR	"	1,957	120	44	59
***W7CT**	**28**	**220,806**	**553**	**34**	**107**
*W7CW	"	154,269	329	26	77
*K7SP	"	95,220	287	31	96
*N7EPD	"	61,004	229	30	71
***K7DBV**	**21**	**171,872**	**476**	**34**	**97**
*W8EQA/7	"	51,728	197	28	78
*KW7R	"	21,450	108	29	46
***N7WA**	**14**	**79,394**	**311**	**29**	**78**
K8GL	**A**	**4,024,440**	**2260**	**154**	**476**
N4ZR/8	**"**	**3,865,932**	**2582**	**129**	**393**
KT8X	**"**	**2,968,031**	**2465**	**120**	**331**
KE8M	"	1,298,440	1018	113	341
K8ER	"	1,018,248	782	124	332
W8KX	"	613,012	607	112	351
W8UPH	"	604,098	692	85	254
W8TWA	"	219,904	335	80	176
W8CS	"	193,950	318	57	168
K8LN	"	156,166	329	68	158
W8RU	"	94,120	192	54	127
K5ZG/8	"	85,879	240	46	111
KC8FXR	"	24,057	113	37	62
KC8IUM	"	8,050	57	14	36
KB8TI	"	100	521	87	241
K8MFO	**28**	**617,430**	**1310**	**36**	**129**
W9LT/8	**"**	**499,380**	**1282**	**34**	**111**
W8JGU	"	432,115	990	36	129
N8NR	"	297,055	958	30	91
WA8TNO	"	80,919	282	31	80
K8DX	**21**	**864,999**	**1840**	**39**	**138**
N9AG/8	**"**	**797,849**	**1699**	**39**	**130**
W8UD	"	198,016	583	34	102
WA8DXB	**7**	**82,720**	**257**	**28**	**97**
K8MD	**3.5**	**23,622**	**137**	**24**	**69**
W8UVZ	**1.8**	**13,774**	**115**	**22**	**49**
***WB8YJF**	**A**	**1,614,645**	**1356**	**136**	**341**
***KB8N**	**"**	**1,281,480**	**1091**	**129**	**343**
*W8GOC	"	592,334	585	90	263
*AA8UP	"	471,888	517	101	247
*N8AA	"	445,876	499	90	226
*W8VE	"	380,664	493	92	219
*W8IDM	"	298,193	400	76	211
*WA8WV	"	291,404	398	71	206
*K8LY	"	235,644	311	73	196
*K8CV	"	145,668	284	53	146
*K8AB	"	125,320	301	84	176
*K8BKM	"	92,771	191	75	128
*KE8PX	"	90,445	426	87	195
*W8PN	"	47,658	129	57	84
*W8RJ	"	38,000	133	30	70
*KG8ZD	"	29,036	135	47	75
*N8WS	"	22,010	205	40	102
***N8AGU**	**28**	**185,234**	**541**	**32**	**99**
*K8IR	"	99,550	338	26	84
***W8IQ**	**21**	**91,320**	**311**	**31**	**89**
*NG3Q/8	"	85,090	399	33	101
*WT8P	"	41,366	268	20	66
***W8UMR**	**14**	**17,702**	**252**	**28**	**78**
*AF8C	"	6,901	85	19	48
W9RE	**A**	**5,033,959**	**3292**	**143**	**410**
				(Op: N9RV)	
K9MA	**"**	**3,170,959**	**2112**	**139**	**388**
W9XT	**"**	**2,562,990**	**1703**	**140**	**415**
WI9WI	"	2,037,217	1798	119	308
N9UA	"	1,157,310	971	117	345
K9CS	"	948,200	804	124	316
K9UQN	"	856,655	818	95	270
W9OA	"	748,880	644	108	299
W9ILY	"	586,500	638	88	257
W9RN	"	519,792	483	125	267
NG9L	"	134,757	266	65	142
N9WKW	"	107,188	279	81	173
K9WJU	"	44,196	201	53	121
K9QC	"	26,838	308	68	145

KB9KEG	*	210	9	7	8
N9TK	**28**	**432,535**	**989**	**33**	**124**
WA9TPO	**"**	**350,608**	**958**	**32**	**104**
W9YYG	*	297,087	753	36	111
K9IG	*	281,512	652	32	122
K9OM	*	252,284	834	30	88
N9XX	*	194,437	533	30	97
KB9S	**21**	**403,604**	**961**	**38**	**126**
K9XD	**14**	**292,334**	**870**	**38**	**119**
			(Op: K9YO)		
K9CAN	*	123,114	329	35	107
K9AN	**7**	**296,240**	**771**	**32**	**108**
K9CJ	*	102,942	332	30	99
W9IXX	3.5	1,353	29	9	24
***KJ9C**	**A**	**1,750,960**	**1248**	**134**	**375**
***N4TZ/9**	**"**	**1,559,376**	**1203**	**126**	**350**
*W9AU	*	1,024,644	912	112	300
*K9YA	*	714,058	767	99	262
*K9JE	*	620,487	638	92	251
*KG9N	*	303,108	564	66	135
*K9KJ	*	180,048	405	54	122
*AA9KH	*	169,164	303	60	162
*N9IJ	*	84,762	220	51	102
*W9TY	*	74,778	208	65	141
*N9NW	*	43,520	128	48	88
*W9YO	*	30,820	120	35	80
*W9HR	*	26,163	124	22	59
*W9ISC	*	1,092	31	12	14
*N9DT	*	100	58	22	37
***K9WA**	**28**	**239,100**	**558**	**33**	**117**
***W9OP**	**"**	**238,670**	**610**	**32**	**113**
*W9GIL	*	84,460	285	28	75
*WB9AYW	*	72,280	247	26	78
***N9WI**	**14**	**41,644**	**146**	**31**	**85**
***K9MMS**	**7**	**88,680**	**276**	**26**	**94**
WBØO	**A**	**2,014,950**	**1379**	**140**	**385**
WØSA	**"**	**1,032,087**	**994**	**102**	**311**
WØZP	*	724,552	871	102	226
KEØUI	*	723,800	839	106	270
WØHW	*	644,598	654	97	249
WØTT	*	524,552	602	97	226
KØRI	*	290,785	480	98	213
WAØSXV	*	270,413	296	96	245
NØRN	*	261,366	371	75	179
KØCAT	*	229,704	404	63	141
			(Op: K9WIE)		
KSØM	*	208,278	293	80	181
WØZQ	*	119,988	238	65	137
KNØV	*	89,142	196	53	113
WØZA	*	81,153	256	39	88
KØJPL	*	47,946	138	49	82
ACØM	*	31,886	152	31	76
WNØL	*	18,512	124	30	74
NØNR	**28**	**579,636**	**1310**	**37**	**125**
N7DR/Ø	*	359,900	1079	29	89
WØART	*	133,625	379	29	96
KØZM	*	83,552	273	28	84
WØAH	**3.5**	**26,166**	**148**	**27**	**62**
KØCS	**1.8**	**2,800**	**36**	**14**	**21**
***KØZV**	**A**	**834,240**	**895**	**102**	**250**
***NAØN**	**"**	**825,664**	**986**	**87**	**217**
*KØVSV	*	424,296	581	98	234
*NØAJ	*	159,278	392	60	157
*AAØAI	*	97,664	318	69	155
*WAØBNX	*	50,920	138	39	95
***KØRS**	**28**	**253,800**	**734**	**33**	**102**
***AEØQ**	**21**	**179,196**	**475**	**31**	**106**
*NØRA	*	149,606	452	33	94
*KGØUA	*	101,844	322	32	91
*KØRY	*	29,029	164	21	56
***WØETT**	**14**	**65,578**	**218**	**30**	**85**
*KØVX	*	4,318	43	9	25

ALASKA

KL7RA	**A**	**2,899,666**	**2952**	**125**	**293**
***AL7IF**	**28**	**242,202**	**910**	**34**	**77**

BAHAMAS

***C6AKP**	**A**	**711,824**	**1413**	**93**	**179**
*C6AGY	*	73,602	426	58	116
			(Op: ND6S)		

BELIZE

V31JP	**7**	**561,688**	**1993**	**29**	**93**
			(Op: K8JP)		

BRITISH VIRGIN ISLANDS

***VP2VF**	**A**	**444**	**25**	**7**	**5**

CANADA

VE1GN	**A**	**4,252,442**	**3360**	**121**	**381**
VO1MP	**"**	**3,696,128**	**2881**	**121**	**391**
VE1AI	*	867,790	1049	94	249
XM1JF	**28**	**647,000**	**2177**	**31**	**94**
VC1A	**3.5**	**513,663**	**1503**	**32**	**109**
			(Op: K3BU)		
***VY1JA**	**A**	**680,988**	**1442**	**79**	**152**
*VO1GO	*	650,525	738	98	295
*VE1GPL	*	557,512	724	81	226
*VE9WH	*	9,450	50	27	43
*VO1WET	*	5,360	167	49	85
*VE1KB	28	56,463	249	18	69
*VO1HE	*	2,376	24	12	24
VE2IM	**A**	**8,158,683**	**5335**	**145**	**466**
VE2AYU	*	1,991,448	1995	109	299
VY2SS	*	585,495	1932	34	101
***VE2AWR**	**A**	**1,452,226**	**1580**	**101**	**296**
*VE2FFE	*	121,550	397	40	103
*VE2MAQ	14	25,200	106	20	80
VE3OI	**A**	**3,413,916**	**3052**	**131**	**335**
VE3AT	**"**	**2,587,536**	**2200**	**117**	**336**
VE3XN	*	1,461,936	1153	129	329
VE3PN	*	1,143,025	1548	99	226
VE3OM	*	504,036	517	103	256
VE3IAY	*	15,075	76	26	49
VA3RU	**28**	**722,722**	**1992**	**34**	**109**
VE3DO	**1.8**	**16,452**	**221**	**14**	**27**
VE3QAA	*	13,284	173	14	27
***VE3KP**	**A**	**1,370,472**	**1462**	**111**	**297**
***VE3ZPD**	**"**	**1,156,326**	**1252**	**124**	**315**
*VE3STT	*	1,057,600	1035	102	298
*VE3OTL	*	575,575	962	100	225
*VE3GFN	*	519,870	719	83	227
*VE3UOL	*	492,426	757	82	215
*VE3ST	*	440,545	539	87	200
*VA3SWG	*	45,652	200	38	63
*VE3LBQ	*	42,340	143	30	86
*VE3BR	*	980	35	15	23
***VE3MQW**	**28**	**48,900**	**221**	**24**	**68**
*VE3KLM	*	33,288	208	20	56
***VA3TTT**	**21**	**73,040**	**342**	**28**	**82**
***VY2MGY/3**	**1.8**	**5,278**	**211**	**6**	**7**
***VE4IM**	**A**	**653,594**	**775**	**107**	**239**
*VE4YU	*	416,466	552	105	201
***VC4X**	**28**	**341,388**	**1313**	**29**	**87**
			(Op: VE4VV)		
*VE4MF	21	57,397	109	28	74
VE5CPU	**A**	**200,900**	**456**	**68**	**137**
***VE5SF**	**A**	**1,604,770**	**2047**	**111**	**272**
*VE5MX	*	9,150	61	30	31
VE6JY	**28**	**556,278**	**1694**	**37**	**101**
			(Op: VE7AV)		
***VE6ZT**	**A**	**567,519**	**901**	**97**	**206**
***VE6BMX**	**28**	**95,366**	**529**	**24**	**58**
***VE6BF**	**21**	**620,739**	**1581**	**39**	**128**
***VE6EX**	**14**	**295,023**	**1066**	**33**	**96**
VE7QO	**A**	**317,830**	**682**	**54**	**131**
VE7IN	**28**	**86,756**	**398**	**26**	**66**
VE7XR	**14**	**597,006**	**1530**	**37**	**116**
***VE7XF**	**A**	**567,363**	**558**	**114**	**265**
***VE7UF**	**28**	**148,707**	**709**	**27**	**66**
*VE7VF	*	118,675	442	28	73
***VC7A**	**21**	**515,637**	**1563**	**35**	**106**
			(Op: VE7SV)		
***VE7SV**	**1.8**	**6,174**	**192**	**9**	**9**

CAYMAN ISLANDS

ZF2NT	**A**	**1,242,032**	**3029**	**50**	**126**

CUBA

***CO8LY**	**A**	**1,687,308**	**2466**	**89**	**229**
***CO8ZZ**	**28**	**433,428**	**1702**	**30**	**84**
*CM2KC	*	228,854	1045	29	77
***CO8DM**	**3.5**	**84,282**	**666**	**15**	**51**

DOMINICAN REPUBLIC

***HI3 /OH3UU**	**A**	**830,648**	**1350**	**96**	**230**
***HI3K**	**7**	**402,875**	**1567**	**25**	**100**

GREENLAND

OX/N6AA	**A**	**4,146,723**	**3859**	**110**	**331**

GUADELOUPE

***FG5BG**	**A**	**7,042,830**	**4894**	**145**	**445**
			(Op: K9NW)		

GUANTANAMO BAY

KG4RF	**21**	**1,034,033**	**3085**	**36**	**107**
			(Op: K8RF)		

MARTINIQUE

FM5BH	**28**	**1,231,864**	**3004**	**37**	**135**

MEXICO

XE1V	**A**	**957,307**	**1416**	**99**	**250**
***XE1RGL**	**A**	**488,180**	**1077**	**75**	**145**
*XE3 /OH2VB	*	63,794	255	61	130

MONTSERRAT

***VP2MGU**	**A**	**2,556,576**	**2924**	**107**	**289**
			(Op: DL7VOG)		

PANAMA

3E1DX	**28**	**1,472,166**	**3913**	**34**	**119**
			(Op: DL5XX)		
***HO3A**	**A**	**208,403**	**406**	**70**	**151**

PUERTO RICO

KP4 /SM5AOE	**A**	**151,368**	**272**	**70**	**142**
KP4GC	*	98,280	117	42	88
WP3A	**28**	**717,286**	**2220**	**35**	**114**
NP3G	*	387,594	1333	27	95
KP3W	**21**	**126,902**	**554**	**30**	**77**
***NP4Z**	**A**	**5,442,660**	**4417**	**129**	**411**
*KP4Y	*	1,568,640	2516	85	219
*WP4LNY	*	21,830	217	28	46

ST. KITTS & NEVIS

V47KP	**A**	**1,681,353**	**2085**	**105**	**276**

TURKS & CAICOS ISLANDS

VP5GN	**A**	**8,408,202**	**5401**	**153**	**485**
			(Op: K5GN)		

U.S. VIRGIN ISLANDS

KP2A	**28**	**1,210,528**	**3251**	**34**	**118**
			(Op: KW8N)		
***WP2Z**	**28**	**882,576**	**2425**	**36**	**108**
			(Op: WD5N)		

AFRICA

AFRICAN ITALY

IH9P	**A**	**8,129,578**	**4855**	**135**	**451**
			(Op: OK1FUA)		

ASCENSION ISLAND

ZD8A	**A**	**9,727,320**	**5506**	**160**	**458**
			(Op: K6NA)		

CANARY ISLANDS

EA8EA	**A**	**13,097,214**	**6444**	**172**	**519**
			(Op: OH2MM)		
EA8ASJ	**14**	**256,676**	**1203**	**27**	**76**
***EA8 /DJ1OJ**	**A**	**1,443,904**	**1474**	**89**	**263**
***EA8FT**	**21**	**654,408**	**1569**	**36**	**113**
*EA8NQ	*	134,068	408	28	93
***EA8CN**	**7**	**537,840**	**1569**	**25**	**95**

ANTARCTICA-Zone 38

R1AND	**A**	**1,565,472**	**1596**	**110**	**258**
			(Op: RW1AI)		

DJIBOUTI

*J28NH	A	2,400	43	21	29

EGYPT

***SU9ZZ**	**A**	**5,370,968**	**3671**	**114**	**395**

GHANA

9G5ZW	**28**	**1,801,182**	**3653**	**38**	**140**
			(Op: OK2ZW)		

IVORY COAST

TU2MA	**21**	**208,320**	**1574**	**29**	**95**

LIBYA

***5A1A**	**21**	**150,150**	**550**	**23**	**68**

MADEIRA ISLANDS

CT3BX	**A**	**5,124,672**	**3924**	**122**	**374**
CT3KN	*	1,319,641	1658	82	265

MALI

TZ6DX	**A**	**1,664,919**	**2221**	**63**	**198**

MOROCCO

***CN8YR**	**A**	**126,868**	**338**	**47**	**114**

NIGERIA

5NØW	**21**	**1,603,641**	**3378**	**37**	**132**
			(Op: OK1RK)		
*5N3CPR	28	20,374	114	18	43

SENEGAL

6V6U	**A**	**9,538,398**	**5508**	**151**	**456**
			(Op: K3IPK)		

SOUTH AFRICA

ZS6EZ	**28**	**2,102,496**	**4149**	**39**	**137**
***ZSØE**	**A**	**311,832**	**599**	**72**	**141**
			(Op: ZS6AJS)		
*ZS5T	*	43,472	211	38	66
*ZS5 /LY2BBF	28	3,948	41	16	26

TANZANIA

*5H3RK	A	37,136	234	25	63

TUNISIA

3V8BB	**A**	**11,729,116**	**6213**	**159**	**538**
			(Op: YT1AD)		

UGANDA

5X1Z	**28**	**1,352,608**	**2734**	**36**	**136**

ASIA

ARMENIA

*EK4JJ	A	45,046	155	38	63
*EK6LP	28	54	378	13	37

ASIATIC RUSSIA

RI9C	**A**	**4,311,360**	**2768**	**137**	**439**
			(Op: RA9CKQ)		
RX9SX	**"**	**3,381,289**	**2762**	**107**	**356**
UA9MA	**"**	**2,640,768**	**2061**	**137**	**392**
RW9UW	*	1,621,521	1667	95	268
UA9LAC	*	1,621,375	1563	108	317
UA9XEN	*	1,575,272	1352	109	337
RU9BJ	*	1,393,737	1527	93	290
UA9AM	*	1,379,664	1374	110	358
RK9CZO	*	1,163,116	1088	90	314
			(Op: RX9CAZ)		
UA9CKS	*	1,132,472	1166	84	290
RA9AN	*	660,510	696	96	273
RA9UV	*	656,970	951	103	263
RZ9UR	*	645,035	844	110	245
RA9AB	*	575,064	600	99	293
UA9CI	*	542,575	744	63	212
UA9XK	*	58,533	148	63	116
UA9XS	*	1,672	21	18	20
RZ9HT	**28**	**405,450**	**1338**	**34**	**116**
RX9LW	*	121,849	519	26	77
RZ9CX	*	62,412	296	19	65
UA9YAB	**21**	**477,636**	**1238**	**35**	**124**
RA9JP	*	200,500	963	24	76
UA9BS	**14**	**339,422**	**944**	**33**	**101**
UA9CNV	*	231,678	786	31	91
RW9TA	*	101,050	452	25	69
UA9CEP	*	2,376	50	9	9
RW9SW	**7**	**310,341**	**866**	**32**	**109**
RW9DX	*	247,308	1004	35	113
UA9XFJ	*	9,455	80	18	43
RV9JK	**3.5**	**216,183**	**852**	**26**	**87**
UA9AT	*	147,100	561	18	82
RA9YY	*	91,549	453	19	64
UA9OS	*	8,880	85	11	37
UA9KM	**1.8**	**28,992**	**221**	**14**	**50**
RU9TO	*	14,259	102	7	42
***RW9QA**	**A**	**979,164**	**1136**	**84**	**270**
***RU9CI**	**"**	**814,986**	**1077**	**86**	**256**
***RK9AD**	**"**	**760,200**	**893**	**103**	**317**
*RA9AUH	*	688,436	800	76	246
*UA9AFS	*	625,140	877	76	226
*RX9JW	*	558,628	864	77	204
*RA9XF	*	515,460	720	65	219
*UA9QCP	*	499,873	658	82	237
*RZ9AE	*	444,682	591	76	246
*UA9JMM	*	236,535	485	50	145
*UA9AX	*	170,624	323	75	173
*UA9JMS	*	153,780	296	71	162
*RA9CZ	*	118,300	314	44	125
*UA9APA	*	118,137	278	37	122
***RZ9OU**	**28**	**311,466**	**1253**	**29**	**93**
*RA9AE	*	188,645	577	31	114
*UA9AB	*	96,558	282	27	94
*UA9CES	*	54,171	220	27	90
*RA9FF	21	13,824	91	19	45
***RJ9J**	**14**	**574,623**	**1702**	**33**	**114**
			(Op: RA9JR)		
*UA9CBM	*	195,881	527	34	115
*RK9AC	*	91,698	500	25	62
***RK9AY**	**3.5**	**112,694**	**508**	**20**	**73**
*RU9TS	1.8	11	122	7	32
RVØAM	**A**	**2,257,270**	**1997**	**140**	**353**
UAØAGI	**"**	**542,361**	**763**	**103**	**244**
RAØFA	*	177,429	380	86	127
UAØFDX	*	52,000	180	47	83
UAØFZ	*	32,016	86	56	82
UAØSBQ	*	30,667	178	30	61
RWØLIS	*	420	10	10	10
UAØLS	28	19,300	77	32	68
UAØDC	**21**	**542,808**	**1930**	**34**	**92**
RAØCG	**3.5**	**78,375**	**635**	**25**	**50**
RAØBA	*	77,040	388	19	71
***RUØLL**	**A**	**1,839,096**	**2409**	**121**	**248**
***UAØANW**	**"**	**1,104,826**	**1257**	**96**	**277**
*RUØBB	*	570,876	735	102	237
*RAØFF	*	493,450	721	98	180
*UAØYAY	*	473,760	781	79	209
*RWØBG	*	469,395	678	87	198
*UAØWW	*	348,036	497	82	217
*RAØZD	*	49,880	124	69	103
*UAØCW	*	28,980	113	35	70
*UAØZAZ	*	24,720	82	53	67
***RAØFW**	**28**	**278,462**	**776**	**38**	**104**
*RUØUQ	*	56,700	300	27	57
*UAØKA	*	14	153	20	21
***UAØSAD**	**14**	**212,003**	**778**	**30**	**82**
*UAØALK	*	112,320	873	20	48
*RZØCQ	*	55,930	217	29	65
*UAØYM	*	54,880	270	26	54
*UAØZS	*	10,692	89	23	31
***RAØJX**	**7**	**67,122**	**350**	**26**	**73**

ASIATIC TURKEY

TA3DD	**A**	**1,050,330**	**1177**	**89**	**225**
***TA3D**	**3.5**	**195,889**	**995**	**15**	**74**

CAMBODIA

XU7AAV	**A**	**4,659,280**	**3772**	**148**	**408**
			(Op: G4ZVJ)		

CHINA

BY1DX	**A**	**3,191,798**	**2875**	**137**	**350**
			(Op: OH2PM)		
BD4ED	**"**	**1,836,016**	**2725**	**109**	**255**
BA1DU	*	232,716	987	57	75
***BA4EG**	**7**	**62,856**	**526**	**23**	**49**

CYPRUS

C4W	**A**	**7,592,409**	**5041**	**142**	**441**
			(Op: 5B4WN)		
5B4AGD	**28**	**1,046,964**	**2529**	**39**	**133**
			(Op: YT6A)		
C4A	**1.8**	**261,489**	**969**	**21**	**80**
			(Op: 9A3A)		

GEORGIA

***4L5O**	**28**	**391,590**	**1195**	**29**	**85**
*4L7AA	14	29,346	200	19	48
***4L2M**	**3.5**	**55,760**	**465**	**12**	**56**

HONG KONG

VR2BG	**28**	**1,005,296**	**2593**	**37**	**129**

INDIA

***VU2PAI**	**A**	**2,080,166**	**1844**	**137**	**369**
*VU2QX	*	62,780	165	63	109

ISRAEL

4X1GA	A	29,520	140	27	55
4X4NJ	**1.8**	**177,744**	**704**	**19**	**73**
***4Z4TA**	**A**	**632,772**	**871**	**58**	**194**
*4X3DIG	*	20,436	124	33	45
***4X1VF**	**28**	**134,880**	**584**	**27**	**69**
***4Z5JZ**	**21**	**166,005**	**571**	**28**	**91**
*4Z5FW	*	130,288	678	30	68
***4Z5JU**	**14**	**106,635**	**318**	**30**	**102**

JAPAN

JA1QOW	**A**	**628,038**	**704**	**118**	**215**
JA1HP	**"**	**497,231**	**644**	**88**	**195**
JA1GTF	*	213,928	321	88	154
JR1GRF	*	169,443	290	66	135
JH1CTV	*	159,040	292	82	142
JR1LEV	*	122,745	303	63	84
7J1ABD	*	105,618	239	69	105
			(Op: WA6URY)		
JH1FSF	**28**	**363,300**	**979**	**35**	**105**
JA1BK	**"**	**202,899**	**579**	**36**	**105**
JA1NLX	*	177,489	608	33	78
JA1SJV	*	144,960	443	35	85
JJ1JRH	*	31,557	168	24	43
JA1QZC	*	7,480	60	21	23
JA1AAT	*	4,196	47	12	20
JH1AEP	**21**	**535,952**	**1346**	**36**	**116**
JR1MQT	*	248,574	834	31	71
JA1GS	*	17,400	110	25	35
JR1XFS	**14**	**202,782**	**587**	**36**	**101**
JH1AZO	*	155,714	525	31	75
JK1LUY	*	88	5	4	4
JK1OPL	**7**	**154,840**	**418**	**33**	**107**
JH1RFM	*	81,600	363	32	88
JE1SPY	1.8	705	22	8	7
***JL1ARF**	**A**	**2,215,448**	**1790**	**143**	**324**
***JJ1VRO**	**"**	**1,155,060**	**1074**	**137**	**277**
***7K4GUR**	**"**	**1,081,530**	**1056**	**118**	**248**
*JN1NOP	*	639,936	780	107	196
*JF1EQA	*	623,809	761	104	209
*JE1REU	*	412,992	573	94	194
*JN1MSO/1	*	379,512	588	94	158
*JJ1QJP	*	374,128	549	89	179
*JA1BUI	*	368,838	493	105	174
*JA1CP	*	350,672	530	86	162
*JG1TVK	*	343,689	436	105	188
*JH1SVO	*	334,006	538	100	174
*JJ1JGI	*	311,952	430	91	177
*JG1OWV	*	285,510	394	118	189
*JA1XRH	*	283,556	457	87	160
*JF1FEV	*	280,924	442	86	168
*JA1PS	*	266,271	426	85	142
*JA1AB	*	257,355	435	76	139
*JP1SRG	*	256,665	391	92	149
*JA7LMU/1	*	235,542	388	83	139
*JH1OAI	*	204,392	350	81	151
*JA8NSF/1	*	183,543	347	72	121
*7J6AAK	*	150,501	366	80	141
*JH1PXY	*	136,230	263	77	113
*JE1HJV	*	122,783	252	71	128
*JA1BPN	*	121,605	269	66	99
*JA1TRP	*	115,244	229	75	113
*JA1XUY	*	97,170	245	63	95
*JA1WHG	*	95,424	208	74	94
*7M3LDC	*	95,023	222	65	102
*JA1XPU	*	87,376	200	69	103
*JA1KI	*	85,995	219	63	84
*JA1HFY	*	79,940	218	56	84
*JR1TMI	*	79,383	207	63	78
*JF1LQP	*	68,474	187	58	76
*JJ1JPE	*	58,302	196	52	71
*JA1BBA	*	45,046	168	40	61
*JA1BCP	*	42,294	137	44	62
*JH1NXU	*	30,305	123	31	64
*JM1SBU	*	26,688	123	43	53
*JI1FLB	*	19,370	172	57	73
*JA1AZS/1	*	16,120	90	27	38
*JA1RRA	*	14,626	124	30	41
*7K1EQG	*	13,585	82	28	37
*JA1HHU	*	10,788	64	24	38
*JA1MXY	*	7,348	62	22	22
*JA1BHZ	*	6,600	149	31	66
*JM1LPN	*	6,237	42	27	36
*JA1EA	*	5,060	37	25	30
***7M1MCT**	**28**	**492,156**	**1192**	**36**	**111**
***JI1RXQ**	**"**	**242,284**	**738**	**35**	**84**
*JH7AJD/1	*	170,189	550	33	76
*JF1SXL	*	142,480	546	31	73
*JR7CJO/1	*	67,468	290	33	68
*JA1VVH	*	63,920	253	30	64
*7M3QQP	*	57,344	328	24	40
*JH1DYV	*	50,688	203	32	64
*JH1BDS	*	44,145	216	28	53
*JP1IXV	*	39,493	200	25	48
*JL1EAN	*	24,568	115	29	54
*JJ1LRD	*	18,018	114	23	43
*JR1LQK	*	13,050	99	21	37
*JH1OLB	*	10,659	86	21	36
*JS1MJE	*	8,320	128	25	40
*7K2PBB	*	4,797	49	15	26
*JA1AAV	*	1,452	22	8	11
***JH1SWD**	**21**	**192,855**	**623**	**32**	**83**
***JJ1GQH**	**"**	**142,848**	**435**	**33**	**91**
*JO1IDL	*	86,025	326	29	82
*JA1EM	*	69,888	272	28	63
*JE1JAC	*	26,696	160	24	47
*JO1WIZ	*	25,608	146	22	44
*JA1BFN	*	1,404	52	14	13
*JG1FGL	14	2,760	29	17	23
***JA1KVT**	**7**	**111,840**	**347**	**32**	**88**
*JH1SBE	*	20,224	108	25	39
*JA1NYV	*	19,584	112	26	46
*JH1AIL	*	9,016	73	18	28
*JE1KDM	*	1,309	29	10	7
JR2AGL	**A**	**2,266,814**	**2030**	**130**	**288**
JH2BCN	**"**	**1,758,291**	**1771**	**133**	**276**
JA2AXB	*	892,672	919	117	235
JH2OMM	*	121,158	268	57	102
JA2QVP	*	40,640	137	59	68
JF2FIU	*	1,813	27	15	22
JA2VQF	**28**	**42,504**	**423**	**28**	**64**
JA2FSM	*	8,346	76	16	23
JE2HVC	**7**	**77,499**	**273**	**30**	**79**
***JA2BY**	**A**	**1,202,973**	**1090**	**134**	**259**
***JA2CUS**	**"**	**525,720**	**672**	**107**	**205**

*JP2XYT	"	481,920	611	107	213
*JA2UOT	"	403,152	630	79	148
*JA9DDF/2	"	341,955	480	93	162
*JA2OJ	"	325,380	469	92	163
*7J6AAK/2	"	263,895	350	71	170
*JA2BQX	"	141,382	314	80	143
*JE2HCJ	"	80,276	254	46	76
*JN2QYN/2	"	51,948	169	48	63
*JH2WIC	"	43,990	159	41	65
*JA2MZ	"	42,372	144	47	60
*JQ2EHD	"	17,976	100	48	59
*JI2VLM	"	11,312	84	28	28
*JJ2TKX	"	9,450	63	32	38
*JK2BAP	"	4,725	41	21	24
***JF2VAX**	**28**	**257,754**	**794**	**33**	**86**
*JA2DHL	"	55,825	249	24	53
*JA2GAL	"	53,218	229	26	56
*JR2TMB	"	44,499	197	28	63
*JH2NWP	"	24,830	153	22	43
*JR2TRC	"	4,392	46	16	20
*JG2VSF	"	4,324	40	16	30
*JN2EIU	"	2,322	30	9	18
***JQ2FFS**	**21**	**175,380**	**562**	**30**	**81**
*JA2MEI	"	8,695	71	17	30
***JJ2QXI**	**7**	**64,684**	**256**	**28**	**75**
*JM2RUV	"	16,401	78	24	53
*JA2KKA	"	15,686	91	22	40
*JL2LPX	"	9,890	90	18	25
JS3CTQ	**A**	**3,370,140**	**2577**	**144**	**330**
JF3CCN	**"**	**1,439,064**	**1300**	**128**	**268**
JE3HDD	"	723,492	779	127	251
JA3ARM	"	328,248	455	101	190
JF3MKC	"	211,310	438	75	112
JA3HBF	"	191,475	310	81	144
JG3WCZ	"	177,968	324	89	138
JA3UWB	"	89,312	334	75	133
JR3XTO	"	19,375	125	55	100
JA3CE	"	8,514	49	29	37
JM3LWR	"	7,728	48	24	32
JA3XOG	**28**	**305,892**	**915**	**33**	**83**
JH3AIU	**21**	**705,282**	**1827**	**34**	**107**
JA3LDH	7	24,386	136	32	57
***JF3GKE**	**A**	**813,010**	**820**	**116**	**273**
					(Op: JI3BFC)
***JH3CUL**	**"**	**409,484**	**497**	**118**	**216**
*JJ3TBB	"	377,559	559	99	174
*JO3JYE	"	354,224	626	95	167
*JG3LGD	"	335,616	514	88	168
*JH3JYS	"	192,042	331	90	137
*JM3XEJ	"	71,383	250	88	133
*JH3TXP	"	69,596	184	52	85
*JA3EVZ	"	65,572	268	30	67
*JA3EOG	"	42,693	150	44	63
*JE3NZV	"	30,368	113	46	58
*JG3NKP	"	24,900	104	27	56
*JA3BQC	"	12,152	72	21	41
*JA3AVO	"	2,077	23	14	17
*JR3NDM	"	1,656	80	40	52
*JA3WFQ	"	1,008	17	11	13
***JF3BFS**	**28**	**228,863**	**754**	**34**	**84**
***JO3UDL**	**"**	**217,000**	**651**	**34**	**90**
***JF3ION**	**"**	**211,437**	**608**	**34**	**89**
*JG3MMD	"	108,160	375	32	72
*JN3SAC	"	80,487	310	28	71
*JN3DSH	"	48,416	229	29	60
*JA3AA	"	45,066	197	26	62
*JA3DAY	"	6,450	45	18	32
*JA3RK	"	5,418	56	16	27
*JF3CHM	"	100	10	6	7
***JK3GWT**	**21**	**257,992**	**706**	**36**	**100**
*JF3IYW/3	"	66,207	317	29	58
*JA3HC	"	7,650	64	20	25
*JK3UAV	14	4,410	52	18	31
*JR3EOI	7	31,862	139	29	60
*JA3ZML	"	98	9	4	3
JH4UYB	**A**	**5,139,152**	**3258**	**172**	**420**
JH4ADK	**"**	**1,119,456**	**1124**	**139**	**277**
JA4ESR	"	272,843	421	88	145
JJ4PPK	"	36,312	198	30	68
JA4XRN	**28**	**339,728**	**972**	**36**	**98**
JA4AQZ	21	19,648	129	23	41
JH4CPC	3.5	9,860	69	22	36
JA4YPE	1.8	128	7	4	4
					(Op: JF3EBO)
***JE4MHL**	**A**	**644,324**	**769**	**104**	**212**
*JA4BAA	"	236,747	401	74	143
*JA4XHF	"	158,456	293	87	145
*JE4JPQ	28	42,900	241	20	40
*JA4ETH	"	27,936	148	25	47
*JK4BOX	"	23,872	142	24	40
*JA4AQR	"	22,083	95	24	55
*JH4JUK	"	3,185	34	16	19
***JR4GPA**	**21**	**99,158**	**433**	**28**	**58**
*JN4BIK	"	90	5	3	3
*JA4TWZ	"	42	3	3	3
***JA4KTE**	**7**	**58,344**	**243**	**29**	**59**
*JE4GJV	"	150	9	3	3
*JI4HKA	3.5	3,219	39	17	20
JA5APU	**28**	**102,255**	**543**	**27**	**58**
JA5IP	7	21,909	119	21	46
JH5FIS	"	20,424	118	28	41
***JH5OXF**	**A**	**1,129,420**	**1153**	**117**	**262**
*JE5AID	"	16,200	84	34	47
***JA5NSN**	**28**	**101,088**	**349**	**32**	**76**
*JR5HXU	"	30,458	115	30	67
*JG5VIA	"	2,178	24	16	17
*JE5XIC	21	8,400	71	18	30
*JF5FGY	"	1,932	23	11	17
*JA5ATN	7	33,750	172	22	53
*JA5JGV	1.8	30	3	3	3
JQ6NAW	**A**	**1,734,700**	**1678**	**130**	**285**
JA6BGA	"	294,224	389	94	190
JA6WIF	**28**	**258,298**	**798**	**36**	**106**
JR6LLN	14	72,295	273	29	66
JA6BZI	**7**	**222,400**	**618**	**33**	**106**
***JH6OPP**	**A**	**734,132**	**934**	**103**	**211**
*JA6BGB	"	97,760	232	67	93
*JA6AKV	"	50,952	142	50	82
*JA6BWB	"	7,568	78	12	29
*JO6EDD	"	2,400	34	17	15
*JH6TYD	28	57,288	242	26	58
*JA6AVT	"	28,446	149	21	45
*JH6WHN	"	14,364	92	30	46
*JA6TQ	"	11,408	126	27	65
*JA6QDU	"	8,073	73	15	24
*JM6NJU	14	132	8	3	3
*JA6WFM	3.5	2,660	47	18	20
JH7BZR	**A**	**449,384**	**755**	**84**	**148**
JA7MJ	"	432,740	542	111	197
JJ7SRA	"	365,980	485	98	192
JA7IC	"	322,542	404	107	190
JA7GAX	"	199,820	375	83	123
JN7OJA	"	36,618	127	34	68
JH7XGN	**28**	**435,240**	**1144**	**35**	**100**
JH7DNO	**"**	**389,058**	**1105**	**33**	**89**
JA7JI	"	137,332	345	36	103
JA7ERJ	"	44,538	209	26	52
JR7RJZ	"	32,196	159	28	49
JA7XBG	**21**	**517,862**	**1300**	**36**	**110**
JA7NI	**1.8**	**8,865**	**82**	**23**	**22**
***JA7ARW**	**A**	**223,450**	**391**	**97**	**143**
***JH7MEX**	**"**	**143,634**	**269**	**75**	**147**
*JF7PHE	"	66,066	206	70	112
*JRØEFE/7	"	36,924	157	49	53
*JH7FUI	"	11,880	71	30	42
*JF7DXT	"	10,168	73	31	31
*JF7GDF	"	8,208	53	26	31
***JH7CJM**	**28**	**122,522**	**415**	**35**	**84**
*JH7IMX	"	102,212	365	33	68
*JI7OED	"	100,556	394	28	64
*JA7COI	"	98,532	372	31	71
*JA7KM	"	59,784	230	32	62
*JH7FUJ	"	25,915	130	24	49
*JA7AXP	"	3,364	44	14	15
*JR7XGL	21	20,658	120	24	42
*JL7IFR	"	3,293	43	16	21
*JF7VVL	14	117	8	5	8
*JA7JHT	7	8,374	68	22	31
JA8RWU	**A**	**3,290,800**	**2514**	**150**	**325**
JA8TEZ	"	2,552	42	12	10
JH8DEH	28	21,762	142	18	36
***JH8SLS**	**A**	**1,680,426**	**1526**	**131**	**283**
*JH8MWW	"	502,227	708	95	172
*JA8JCR	"	290,783	462	99	172
*JE8KKX	"	25,344	101	44	55
*JA8GG	"	2,208	23	16	16
***JA8LN**	**28**	**123,318**	**382**	**35**	**82**
*JA8DCG	"	26,496	147	22	47
*JA8AT	"	5,282	47	13	25
*JA8GTO	7	209	7	4	7
JA9CWJ	**A**	**1,558,374**	**1581**	**114**	**244**
*JE9VOI	A	135,424	280	73	111
*JA9KUG	"	42,205	143	47	68
*JA9RO	"	12,267	88	43	49
***JH9VSF**	**28**	**269,576**	**913**	**37**	**87**
***JH9KVF**	**21**	**271,212**	**809**	**32**	**94**
*JA9DOF	7	1,026	21	7	11
JHØGHZ	**A**	**864,624**	**837**	**130**	**283**
JRØWZR	**"**	**724,353**	**741**	**106**	**251**
JEØEHE	"	165,682	334	94	93
JAØFVU	"	41,021	131	49	78
JAØHC	"	35,454	115	49	65
JHØFUW	**28**	**442,256**	**1255**	**35**	**96**
JGØOXL	21	58,135	329	25	52
JAØRCK	"	1,728	22	13	19
JAØGZ	14	336	10	5	7
***JEØUXR**	**A**	**2,267,954**	**1784**	**144**	**350**
***JRØBQD**	**"**	**795,704**	**797**	**125**	**239**
*JHØNEC	"	186,293	355	86	155
*JAØBJY	"	170,451	376	56	121
*JAØEKI	"	114,744	249	74	94
*JAØBPY	"	55,110	164	68	99
*JGØEXP	"	50,760	168	47	88
*JRØEFE	"	36,924	157	49	53
*JAØEMS	28	90,783	322	32	67
*JAØGEY	"	12,975	79	34	41
*JAØIOF	21	15,147	107	19	32
*JAØDOW	"	390	10	8	7
***JHØEPI**	**14**	**138,745**	**476**	**35**	**80**
*JAØADY	7	9,840	75	20	28
*JRØBAT	"	8,201	83	20	39

JORDAN

JY9NX	**A**	**6,725,952**	**4274**	**133**	**443**
					(Op: JM1CAX)

KAZAKHSTAN

UPØL	**A**	**4,742,589**	**3348**	**133**	**446**
					(Op: UN9LW)
UP6F	"	22,572	92	39	69
UN7JX	**28**	**41,040**	**208**	**28**	**80**
UN7/AB8CK	**14**	**774,228**	**2089**	**35**	**121**
UN9LY	**7**	**349,125**	**1380**	**36**	**111**
UN7CW	**3.5**	**223,616**	**943**	**31**	**97**
***UP6P**	**A**	**1,480,365**	**1698**	**132**	**359**
					(Op: UN6P)
*UN7LF	"	919,524	1146	81	246
*UN9FB	"	8,528	53	37	45
***UN5J**	**28**	**124,800**	**455**	**30**	**98**
***UN8PF**	**21**	**85,752**	**330**	**28**	**80**
***UN4PG**	**7**	**46,872**	**221**	**21**	**72**
***UN2O**	**1.8**	**45,778**	**310**	**12**	**48**

KOREA

***HL5UOG**	**A**	**150,220**	**310**	**70**	**115**
*HL5AP	28	41,339	220	21	46

KUWAIT

*9K2/OK1TYM	A	65,366	167	37	124

KYRGYZSTAN

EX8W	**A**	**5,927,040**	**4159**	**136**	**452**

LEBANON

OD5/F5SQM	**A**	**875,866**	**2121**	**57**	**205**
***OD5NJ**	**A**	**245,889**	**585**	**43**	**146**

MACAO

***XX9TDX**	**A**	**3,333,666**	**3250**	**140**	**353**
					(Op: SMØGNU)

OMAN

A45XR	**A**	**9,363,900**	**5317**	**145**	**492**

PAKISTAN

***AP2NK**	**A**	**818,177**	**1247**	**87**	**230**
*AP2N	"	90,624	221	63	129
					(Op: DF2RG)

PALESTINE

E4/S53R	**A**	**8,391,987**	**4914**	**151**	**488**
E41/OK1DTP	**21**	**1,229,728**	**2862**	**40**	**126**

SAUDI ARABIA

HZ1AB	**A**	**6,225,287**	**4370**	**130**	**411**
					(Op: SMØCXU)

SINGAPORE

9V1YC	**28**	**730,750**	**2131**	**37**	**121**
***9V1XE**	**7**	**49,864**	**321**	**27**	**65**
					(Op: VK3DXI)

SRI LANKA

*4S7OF	A	42,598	131	41	77

TAIWAN

BWØR	**A**	**1,347,138**	**2711**	**100**	**203**
					(Op: JA1JKG)
BV7FF	**28**	**290,895**	**1125**	**34**	**95**

TAJIKISTAN

***EY8MM**	**28**	**512,796**	**1442**	**35**	**116**

THAILAND

HS1RU	**A**	**644,832**	**1513**	**101**	**187**

UNITED ARAB EMIRATES

A61AO	A	50	14	12	13

UZBEKISTAN

UK9AA	**A**	**3,312,286**	**2659**	**119**	**372**

VIETNAM

3W7TK	**A**	**125,259**	**399**	**36**	**93**
					(Op: OK1HWB)
***3W7CW**	**28**	**140,600**	**730**	**26**	**74**
***XV7SW**	**21**	**583,766**	**1777**	**37**	**114**
					(Op: SM5MX)

WEST MALAYSIA

9M2TO	**A**	**2,107,037**	**2610**	**119**	**286**
***9M2JI**	**A**	**349,720**	**671**	**96**	**184**
					(Op: JK1AJX)

EUROPE

ALAND ISLANDS

OHØZ	**A**	**6,212,463**	**4608**	**159**	**514**
					(Op: OH7JT)
OHØV	**21**	**1,051,380**	**2721**	**38**	**142**
					(Op: OH6LI)

AUSTRIA

OE2BZL	**A**	**1,969,572**	**2232**	**107**	**366**
OE8CIQ	"	710,723	1348	77	222
OE6HZG	"	324,805	880	56	191
OE/OK1FIA	"	18,304	84	39	65
OE3TL	**7**	**51,300**	**267**	**22**	**78**
OE3GSA	**1.8**	**56,394**	**730**	**10**	**68**
***OE1JIS**	**A**	**111,228**	**350**	**42**	**146**
*OE1BKA	"	70,950	247	43	86
***OE3I**	**28**	**252,927**	**813**	**38**	**119**
					(Op: OE1JNB)
***OE2GEN**	**14**	**119,272**	**540**	**36**	**100**
***OE2LCM**	**3.5**	**55,440**	**540**	**16**	**74**

BALEARIC ISLANDS

EA6GP	**A**	**176,834**	**550**	**57**	**181**
EA6ZS	"	40,828	210	27	91
*EA6YW	A	39,312	160	47	79
***EA6/DL8NBY**	**21**	**211,950**	**926**	**32**	**103**

BELARUS

EU1DX	**A**	**2,314,920**	**2056**	**131**	**442**
EU1MM	**"**	**1,690,200**	**2377**	**111**	**339**
EW3CW	"	163,680	346	67	181
EW1WN	"	78,603	271	56	141
EW8EW	**28**	**500,480**	**1344**	**38**	**132**
EW2AA	"	176,436	450	39	130
EW6GB	**21**	**120,294**	**516**	**26**	**97**
EU4EU	"	70,983	385	24	75
EW3EW	**14**	**217,556**	**877**	**35**	**102**
EW6TU	"	97,812	852	22	77
EU5A	**7**	**424,960**	**1571**	**39**	**121**
					(Op: EU1FC)
EW5O	"	48,150	455	20	55
					(Op: EW8MW)
EW3LN	"	22,995	137	20	43
EW1WZ	**3.5**	**190,670**	**1218**	**24**	**91**
EW8DX	**1.8**	**31,872**	**546**	**9**	**55**
***EW2CR**	**A**	**2,494,010**	**2535**	**127**	**414**
*EU1PA	"	453,879	883	74	259
*EW1EA	"	375,624	633	70	212
*EW8OS	"	169,884	307	80	283
*EU1SA	"	143,780	311	57	125
*EW1NA	"	30,840	176	37	83
*EW1BA	28	21,600	109	26	64
*EW2CM	21	27,235	219	20	45
***EU6AA**	**7**	**41,678**	**351**	**19**	**72**
***EW8RR**	**1.8**	**7,236**	**197**	**6**	**30**

BELGIUM

ON6ZX	**28**	**148,894**	**627**	**31**	**78**
ON5UM	**21**	**626,500**	**1739**	**40**	**139**
ON4AEK	**7**	**509,151**	**1943**	**36**	**121**
ON4BR	3.5	8,000	236	10	40
***ON7NQ**	**A**	**812,072**	**948**	**87**	**245**
*ON4XG	"	490,699	778	80	261
*ON4AOI	"	420,858	478	127	327
*ON7SS	"	166,100	511	52	168
*ON4CAS	"	33,972	136	40	74
***ON6CW**	**21**	**107,353**	**544**	**26**	**76**
***ON6TJ**	**3.5**	**24,566**	**283**	**11**	**60**

BOSNIA-HERZEGOVINA

T99W	**28**	**619,752**	**1750**	**40**	**128**
***T95C**	**A**	**242,858**	**616**	**72**	**194**
*T94YT	"	141,708	413	66	130
***T91AAW**	**7**	**214,185**	**974**	**26**	**105**
*T92M	"	73,528	453	21	83

BULGARIA

LZ6A	**A**	**2,110,620**	**2043**	**146**	**434**
LZ1BJ	**"**	**1,316,224**	**1816**	**105**	**343**
LZ2EV	"	525,504	900	87	270
LZ1QZ	"	465,397	970	79	258
LZ5QZ	"	21,580	154	43	87
LZ1BG	"	4,644	31	23	31
LZ4HM	"	3,124	46	18	26
LZ1NG	**28**	**318,330**	**1416**	**36**	**126**
LZ5W	"	120,913	467	32	99
					(Op: LZ1RB)
LZ2K	**21**	**252,650**	**889**	**37**	**118**
					(Op: LZ2JE)
LZ9F	**"**	**247,860**	**1040**	**34**	**101**
					(Op: OK1DF)
LZ9A	**7**	**694,212**	**2238**	**36**	**130**
					(Op: LZ2HM)
LZ2CJ	"	329,186	1364	31	112
LZ3AB	**1.8**	**36,300**	**473**	**12**	**63**
***LZ2NB**	**A**	**571,162**	**883**	**83**	**264**
***LZ1MC**	**"**	**504,680**	**834**	**88**	**253**
*LZ1UQ	"	485,722	782	108	314
*LZ1AG	"	361,836	500	102	312
*LZ1QH	"	91,827	237	55	124
*LZ2MP	"	57,104	206	47	119
*LZ1NJ	"	43,654	299	42	104
*LZ4BU	"	26,260	94	45	56
*LZ4WX	"	10,692	59	31	50
***LZ1IA**	**28**	**74,160**	**320**	**27**	**76**
*LZ2TF	"	54,984	288	22	57
*LZ2GS	"	17,404	88	26	50
***LZ1CW**	**21**	**221,850**	**708**	**36**	**117**
*LZ2FM	"	19,116	126	20	61
*LZ1FJ	14	6,204	107	7	37

CROATIA

9A2AJ	**A**	**2,145,564**	**2198**	**129**	**428**
9A2EU	"	35,990	112	50	68
9A3ST	"	18,130	115	32	42
9A6A	**28**	**468,700**	**1369**	**39**	**133**
9A3MR	"	458,874	1372	37	122
9A3TN	"	63,400	256	27	73
9A5W	**21**	**951,993**	**2481**	**40**	**149**
9A3GW	**14**	**904,722**	**2517**	**40**	**142**
9A4X	"	234,522	1343	34	95
9A9A	**7**	**1,007,591**	**2986**	**40**	**139**
9A4W	**3.5**	**163,368**	**1134**	**20**	**87**
***9A5I**	**A**	**1,319,714**	**1360**	**122**	**416**
*9A2NO	"	824,913	950	106	347
*9A3CY	"	673,254	1135	76	263
*9A5Z	"	350,110	607	70	200
					(Op: 9A3LM)
*9A3SM	"	97,693	195	65	146
*9A2WJ	"	66,882	160	53	104
***9A9R**	**28**	**287,421**	**895**	**35**	**114**
***9A2R**	**"**	**281,702**	**802**	**40**	**126**
*9A3VM	"	219,912	1019	30	89
*9A6KOI	"	138,996	451	38	105
*9A5ST	"	122,980	506	32	98
***9A5Y**	**21**	**474,846**	**1360**	**39**	**135**
***9A7T**	**3.5**	**61,760**	**619**	**17**	**63**
***9A7R**	**1.8**	**94,822**	**945**	**14**	**77**
*9A3RE	"	12,788	289	5	41

CZECH REPUBLIC

OK1EP	**A**	**2,197,750**	**2040**	**135**	**455**
OK2PDT	**"**	**1,543,817**	**1649**	**107**	**372**
OK1FPS	**"**	**1,503,579**	**1689**	**110**	**373**
OK1AVY	"	1,436,400	1442	116	359
OK1DWC	"	1,041,180	1153	150	405
OL4M	"	985,982	1431	93	328
OK1PG	"	949,870	1155	103	327
OK2HBR	"	896,580	1358	82	258
OK2ABU	"	831,831	1021	92	337
OK1DXW	"	579,012	797	87	279
OK2SG	"	450,375	556	94	281
OK2SGY	"	437,101	817	74	213
OK2ON	"	437,052	769	78	223
OK1FTW	"	262,492	400	76	198
OK1DVM	"	217,100	488	64	196
OK1FRO	"	73,280	257	46	114
OK2PSA	"	2,982	51	16	26
OK2RZ	**28**	**780,922**	**1950**	**39**	**134**
OK1KT	"	347,776	839	40	136
OK1AU	"	185,234	583	37	94
OK2BJT	"	133,176	405	29	95
OK1PN	"	35,805	200	28	65
OK1JN	"	165	8	5	6
OK1FZM	**21**	**352,814**	**980**	**35**	**119**
OK2SAT	**"**	**316,687**	**938**	**38**	**123**
OK1VD	"	280,423	939	34	109
OK2OP	"	79,076	376	24	82
OK1XC	**14**	**109,210**	**552**	**33**	**101**
OK1AXA	"	65,665	393	28	87
OK1SGI	"	36,480	328	14	50
OK1KZD	"	31,232	316	13	48
					(Op: OK2SGI)
OK1RF	**7**	**1,040,910**	**2673**	**39**	**131**
OK2BVG	"	263,578	1002	32	112
OK2EQ	"	95,590	600	20	90
OK1TO	**3.5**	**94,848**	**710**	**19**	**85**
OK1FC	"	90,616	776	20	74
OK1EW	"	83,378	842	19	75
OK1RP	**1.8**	**61,680**	**779**	**12**	**68**
OK2ZU	"	49,686	633	11	67
OK1TP	"	17,918	241	11	51
OK2PWJ	"	6,552	116	7	45
OK1DWJ	"	3,136	45	6	43
***OK2PP**	**A**	**1,875,976**	**2007**	**126**	**431**
***OK1DSZ**	**"**	**1,860,089**	**1678**	**117**	**422**
***OK1JOC**	**"**	**1,663,088**	**1727**	**104**	**392**
*OK1QM	"	1,554,960	1658	100	365
*OK1HX	"	1,291,050	1383	106	369
*OK1BA	"	1,231,194	1322	104	367
*OK2QX	"	1,191,500	1363	107	393
*OK2HI	"	760,875	1176	91	284
*OK1AYY	"	746,760	1038	94	287
*OK1FCA	"	707,824	1230	66	262
*OK1SI	"	636,272	1025	84	280
*OK1MKI	"	625,833	993	79	272
*OK1OX	"	437,437	774	75	224
*OK1IPN	"	428,582	859	67	186
*OK2TBC	"	357,084	637	66	168
*OK2PBG	"	309,150	533	62	208
*OK2BND	"	269,328	505	65	183
*OK2BRV	"	259,692	686	59	209
*OK1FKV	"	196,784	707	44	207
*OK1AOU	"	172,224	387	57	151
*OK1KZ	"	127,925	372	48	127
*OK2SWD	"	127,544	383	48	166
*OK2BNC	"	123,384	272	61	133
*OK1DVK	"	99,718	322	36	110
*OK1PDQ	"	61,308	196	43	88
*OK2BWC	"	46,645	199	39	56
*OK2AJ	"	34,272	182	13	13
*OK1JDJ	"	7,095	79	14	41
*OK1CNN	"	5,936	51	24	29
*OK1JEG	"	5,120	111	12	52
*OK6L	"	4,731	36	23	34
*OK1FPE	"	100	6	3	5
***OK2PAY**	**28**	**389,693**	**896**	**40**	**141**
***OK2ZC**	**"**	**195,920**	**584**	**36**	**122**
***OK1CZ**	**"**	**193,742**	**583**	**36**	**110**
*OK1FHI	"	178,935	462	35	116
*OK1DOL	"	158,522	520	32	102
*OK1AES	"	149,885	377	35	110
*OK2PO	"	134,788	441	33	91
*OK1ACF	"	133,200	415	31	89
*OK2BNF	"	71,496	314	28	80
*OK1UG	"	51,810	207	31	79
*OK2ZJ	"	50,050	252	27	64
*OK1BMW	"	33,516	127	27	87
*OK2VP	"	23,464	151	19	37
*OK2BHE	"	14,147	120	19	28
***OK1FKM**	**21**	**244,745**	**735**	**37**	**118**
***OK1DCF**	**"**	**213,876**	**653**	**38**	**118**
*OK1MNW	"	213,367	609	38	125
*OK2HZ	"	176,299	572	33	107
*OK2PCN	"	122,944	460	31	105
*OK1LL	"	111,562	428	30	91
*OK2WM	"	85,310	375	25	70
*OK1ILM	"	28,720	266	20	60
*OK2QA	"	26,625	190	16	55
*OK2BH	"	23,460	119	26	66
*OK1MMN	"	7,298	131	12	29
***OK1DKO**	**14**	**97,440**	**415**	**27**	**93**
*OK2DU	"	49,045	391	15	70
***OK1HCG**	**7**	**73,191**	**479**	**18**	**75**
*OK1GS	"	71,386	426	20	76
*OK1DKM	"	10,718	114	13	33
*OK2BTK	"	9,168	169	7	41
***OK1FOG**	**3.5**	**41,160**	**496**	**12**	**72**
*OK2STM	"	1,782	106	5	28
*OK1DUO	1.8	1,596	54	6	32

DENMARK

OZ1LO	**A**	**4,658,952**	**3661**	**146**	**455**
OZ8NJ	"	543,370	1021	72	263

OZ5MJ	"	395,648	643	98	254
OZ7BW	"	95,076	229	56	115
OZ7YL	"	55,440	200	37	95
*OZ1AA	A	1,528,166	1724	109	369
*OZ5ABD	"	364,738	801	69	212
*OZ/OY1CT	"	344,687	620	65	222
*OZ5EDR	"	251,625	659	61	214
*OZ4FF	"	245,520	451	66	198
*OZ5UR	"	168,715	424	52	153
*OZ7BQ	"	31,680	102	42	68
*OZ5RM	"	12,096	130	17	46
*OZ5DX	28	37,204	200	22	49
*OZ1APA	"	15,675	120	16	39
*OZ7JQ	21	3,680	45	13	19
*OZ /SM7GCZ	14	33,065	203	15	70
*OZ1BMA	"	27,060	330	16	66

DODECANESE

J45KLN	A	683,424	1786	62	226
					(Op: SMØCMH)
*SV5DZX	A	46,854	365	42	129

ENGLAND

GØIVZ	A	4,233,732	3490	138	461
G3TXF	"	2,437,394	2071	131	431
G3UFY	"	1,846,520	2062	94	330
G4BJM	"	1,325,340	1810	98	272
G3WUX	"	1,041,216	1604	94	314
G3RSD	"	599,186	978	76	261
GØLZL	"	591,838	987	74	264
G3LZQ	"	224,145	383	75	218
G3NAS	"	96,432	291	63	133
G3WVG	28	537,840	1312	37	129
G3WGN	"	366,288	1081	37	119
G8D	"	314,696	1083	33	106
					(Op: G3SJJ)
G4BUO	21	835,086	2141	40	137
G5G	"	626,316	1761	38	126
					(Op: GØLII)
G3PJT	"	442,636	1300	38	126
G3UOF	"	314,360	958	35	110
M7Z	7	826,485	2552	38	127
					(Op: G3VHB)
G4HTD	"	200,655	956	27	78
*G3WGV	A	2,369,120	2217	110	426
*G4IIY	"	1,460,891	1645	98	339
*G3KKP	"	907,062	1200	84	293
*G4TSH	"	562,020	898	78	262
*G6QQ	"	525,018	832	73	245
*G3JKY	"	428,532	784	66	202
*G3VQO	"	401,016	774	64	244
*G3GGS	"	346,320	510	75	221
*G4DDX	"	183,887	473	59	170
*G3HZL	"	177,735	459	61	194
*G3JJZ	"	168,720	328	71	157
*G3WRR	"	155,023	377	52	135
*G4IDL	"	128,757	298	65	192
*G4ZME	"	77,088	293	36	79
*GØWHO	"	76,160	278	40	79
*G4SLE	"	44,616	291	40	103
*GØMRH	"	11,466	104	22	41
*GØMTN	28	304,155	1032	32	103
*GØDEZ	"	214,764	759	31	101
*G4UZN	"	213,591	586	34	113
*G4IUF	"	53,998	165	32	101
*G3IZD	21	36,848	202	24	70
*M5X	7	76,950	526	15	80
					(Op: G3KKQ)
*G5MY	"	63,360	264	18	102
*MØAJT	"	13,395	159	11	36
*G3XWZ	1.8	6,179	91	6	31

ESTONIA

ES6PZ	A	881,160	1105	99	321
ES1OX	"	489,230	1133	88	318
ES2X	28	623,002	1599	40	141
					(Op: ES2RJ)
ES7RE	14	593,217	1718	40	133
*ES6DO	A	933,660	1061	103	365
*ES4RD	"	598,410	943	98	268
*ES2DJ	"	548,120	771	95	260
*ES1QX	"	34,441	161	40	61
*ES3BQ	"	16,800	114	19	37
*ES1BH	"	9,430	104	23	59
*ES1QD	28	294,168	727	38	130
*ES6CO	"	14,931	136	22	57

EUROPEAN RUSSIA

RM4W	A	4,079,160	3232	149	499
					(Op: RW4WR)
UA4WA	"	2,065,190	2077	132	465
RW1ZA	"	1,942,230	2181	112	365
RU6AV	"	1,578,528	1640	130	392
UA6LJ	"	1,553,162	1636	121	412
UA1OMS	"	1,535,760	1562	130	410
RT3A	"	1,503,648	1702	133	419
					(Op: RU3AA)
RZ3AA	"	1,202,432	1751	109	379
RK3WWA	"	1,199,016	1429	118	350
					(Op: UA3WU)
RU3FF	"	745,010	1109	94	273
RA3RN	"	631,968	797	119	335
RW6BQ	"	594,546	871	114	280
UA3AGS	"	520,080	816	91	303
RW3DW	"	426,762	666	92	286
RW3GU	"	411,240	745	80	150
RA3UF	"	384,129	712	95	274
RN6BY	"	317,955	1084	35	130
RA6LBS	"	311,248	1007	100	297
RN3FA	"	293,290	507	96	182
RZ1ZB	"	283,024	425	88	216
UA3PB	"	254,217	416	84	219
RA3NB	"	202,566	362	72	246
RX3RZ	"	191,673	506	60	169
RA1TC	"	167,860	463	60	160
RK6BZ	"	135,252	419	43	161
RV1CC	"	115,774	341	69	145
RK1QXW	"	115,752	414	41	115
					(Op: RW1QY)
RA3ANL	"	115,182	344	66	171
RZ1AZ	"	110,320	279	58	139
RV3DAR	"	107,598	206	81	146
RN6HZ	"	92,984	212	74	123
RN1AM	"	90,948	389	45	87
RU3DX	"	86,400	282	59	141
UA3UCD	"	75,438	208	49	149
UA6AAY	"	54,112	215	59	93
RA3BB	"	46,592	323	27	64
RA1AIM	"	41,613	239	28	69
RW3LA	"	38,192	137	50	104
RA1ABU	"	38,007	177	41	82
RW1QF	"	14,061	76	40	69
RW1QY	"	950	14	12	13
RA3AJ	28	373,556	969	40	148
UA3AB	"	341,972	883	40	148
RU4CO	"	302,560	1076	34	126
RV6LOB	"	2,736	64	10	26
RV6AB	"	26	141	24	66
RZ3QU	21	556,864	1580	40	136
RA6CM	"	525,278	1515	40	138
RK6CZ	"	364,895	1271	38	129
RU6FA	"	342,705	1105	37	128
RA3XO	"	298,800	846	38	128
RV6YB	"	137,514	554	29	94
RK3XWD	"	131,040	691	30	90
RW4AA	14	504,142	1650	36	130
RV1AC	"	251,535	1064	29	94
RK3SWB	"	116,204	559	34	105
UA3EJU	"	42,588	325	20	58
RU3MW	"	26,939	246	21	58
RW1ZZ	7	270,572	970	36	122
RW4PL	3.5	147,899	716	30	101
RW3FO	"	127,680	886	22	90
RA3XA	"	47,971	391	15	74
RA3DOX	1.8	35,668	393	13	61
UA6LV	"	34,496	325	18	70
RA6AX	"	31,620	291	17	68
*RA1ACJ	A	1,933,792	1668	137	486
*RA3AF	"	1,354,200	1517	114	374
*UA4WAN	"	1,188,915	1522	117	390
*RV3LO	"	1,120,560	1437	107	357
*RW3AX	"	1,117,395	1302	102	363
*RA3NZ	"	996,030	1265	105	360
*RU3AQY	"	967,932	1396	89	325
*RA3UT	"	926,796	1203	111	346
*RU4WE	"	834,847	1286	101	330
*RN3AY	"	784,576	1206	101	315
*UA1ANA	"	748,605	1030	93	336
*RA1QX	"	722,892	921	98	330
*RK3DK	"	699,966	1033	91	242
*UA1TAN	"	663,960	1005	94	346
*RA3UAG	"	607,131	913	101	318
*UA1RJ	"	602,316	920	99	297
*UA3IKO	"	546,840	1087	77	283
*UA3XAC	"	449,540	736	80	258
*UA1OAM	"	447,432	828	89	220
*RV4LM	"	398,300	776	78	272
*RN1AO	"	380,970	998	67	182
*RW3YA	"	347,065	608	78	249
*RA4NF	"	326,230	617	85	238
*UA4RF	"	296,712	530	82	235
*RA4CTR	"	285,480	553	70	164
*RW4FZ	"	275,720	595	77	228
*UA3SAQ	"	269,767	586	82	235
*UA3RS	"	251,217	445	71	238
*UA4FEN	"	232,440	511	78	234
*RX3AEX	"	226,008	566	83	209
*RU3AL	"	199,716	526	63	204
*RK4CB	"	183,604	430	62	171
*UA1TBK	"	173,634	363	76	182
*RA1AKE	"	171,360	396	56	148
*RK3RX	"	147,768	445	62	200
*UA4FER	"	127,840	363	46	142
*RW3XA	"	121,412	223	82	172
*RV3YR	"	113,142	421	46	127
*RN3AU	"	92,442	272	54	132
*UA1AJW	"	88,452	210	63	180
*UA4RC	"	78,518	183	67	99
*UA3DJG	"	63,742	203	47	110
*UA3LPF	"	59,124	312	33	123
*RA1TV	"	42,441	208	36	93
*RW1QS	"	30,580	104	47	92
*UA3YCX	"	30,494	217	25	70
*RU3RQ	"	28,130	150	23	74
*RA3UR	"	24,875	117	47	78
*RK3BR	"	24,200	137	27	73
*RA3UM	"	24,104	89	43	88
*RA3XI	"	15,416	214	19	63
*RA4UAT	"	12,986	91	38	48
*UA4LL	28	433,488	1245	38	138
*RV6YY	"	204,320	631	38	122
*UA3VCS	"	170,665	581	33	112
*RV3AH	"	159,612	567	31	110
*UA3XBB	"	62,818	293	25	73
*RU3WR	"	45,117	286	22	59
*UA3ABT	"	32,970	141	24	81
*UA6ATG	"	26,520	122	26	76
*UA6ART	"	377	27	9	20
*UA4CJJ	21	253,968	854	34	122
*RW4WM	"	213,693	735	34	129
*UA4NCI	"	149,796	537	32	114
*UA4QK	"	63,140	237	25	85
*RV6AA	"	37,101	245	22	61
*UA4SBZ	"	24,716	190	17	57
*UA3ABJ	14	159,800	728	33	103
*RA3SL	"	136,347	658	32	109
*RA1OK	"	113,988	495	28	90
*RZ6FZ	"	91,098	515	32	94
*RA3NX	"	58,580	333	25	76
*UA1ONG	"	40,590	314	21	61
*RA6LAE	"	40,495	267	20	69
*RU4PL	7	324,348	1246	35	116
*RW6AHO	"	159,345	501	23	80
*RW3DU	"	30,176	219	19	73
*UA3YKG	3.5	34,428	305	10	53
*RW3DY	"	28,210	326	11	59
*UA6AKD	"	27,289	319	12	58
*UA3TJC	"	7,742	104	10	39
*UA3LIZ	"	5,676	117	7	37
*UA6XT	1.8	2,244	47	7	27

FINLAND

OH5LF	A	5,255,874	3451	166	536
					(Op: OH1WZ)
OH7A	"	3,542,548	2753	154	474
					(Op: OH7MA)
OH5CW	"	2,889,844	2760	128	398
OH1JD	"	2,873,864	2522	136	375
OH8LAE	"	2,839,536	1958	148	500
OH1VR	"	2,200,165	1979	134	411
OH3MMM	"	1,983,816	2199	119	353
					(Op: OH3RM)
OH6XY	"	551,670	789	114	312
OH2VZ	"	495,000	802	90	270
OH3JR	"	327,624	407	110	328
OH1BOI	"	265,963	437	79	238
OH2LYP	"	130,640	542	60	170
OH1BV	"	89,535	435	59	176
OH5JOC	"	74,939	321	41	96
OH1TV	"	70,452	242	39	64
OH5PT	"	63,221	135	77	114
OH2KU	"	56,280	216	43	50
OH3BU	28	460,460	1233	39	143
OH6OS	"	458,640	1344	36	111
OH8OB	"	376,830	629	83	235
OH3RR	"	238,920	677	39	126
OH2KQ	"	23,310	78	33	72
OH5NZ	"	21,090	103	29	45
OH2RA	21	380,860	1392	32	105
OH3FM	"	232,392	908	33	105
OH3TR	"	104,780	444	29	95
					(Op: OH3IR)
OH8LQ	14	738,164	2352	37	127
OH3MC	"	41,718	214	24	78
OH2BCD	"	40,796	336	20	39
OH5XL	7	164,576	730	36	112
OH6ZH	"	74,250	237	31	94
OH2BMH	"	29,000	117	28	88
OH5UFO	3.5	110,799	706	24	93
OH2BYS	"	105,600	711	20	90
*OH8BQT	A	1,133,262	1222	118	383
*OH3WW	"	927,129	1287	85	286
*OH2NN	"	783,104	947	99	338
*OH6FW	"	94,940	327	48	140
*OH7DK	"	87,236	286	57	169
*OH7JHI	"	84,609	345	39	114
*OH2FS	"	42,900	117	56	100
*OH5NE	"	34,001	158	33	88
*OH2SS	"	14,792	94	28	58
*OH1KF	28	153,780	448	35	115
*OH4A	"	111,720	559	34	99
					(Op: OH4JLV)
*OH3KOK	"	65,096	277	28	75
*OH3TZ	"	14,278	242	16	43
*OH5PA	"	3,402	35	13	29
*OH8NLC	21	162,000	519	33	111
*OH3WR	"	75,755	210	35	104
*OH7WD	"	72,947	287	28	91
*OH6MBQ	"	60,420	329	23	72
*OH6RC	7	21,983	247	17	72

FRANCE

F5JBR	A	1,337,564	1349	111	397
F6FTB	"	806,508	1098	88	299
F6IRA	"	803,880	1117	108	327
F2AR	"	317,668	674	70	228
F9CI	"	278,046	360	98	244
F8AWQ	"	152,852	508	59	147
F6CAV	"	143,520	430	50	145
F5RZJ	28	344,568	990	39	129
F5NBX	"	333,150	1088	36	114
F6HKA	21	471,546	1438	36	117
F6CWA	1.8	27,824	364	10	64
*F6ACD	A	675,740	912	88	301
*F5NQL	"	493,839	1046	69	264
*F5YJ	"	382,214	695	74	248
*F5OIU	"	379,125	602	91	246
*F5POJ	"	369,370	895	54	161
*F5UKL	"	358,820	960	63	170
*F6HHR	"	302,652	603	65	187
*F8AKC	"	300,720	502	75	205
*F5ROX	"	272,845	752	70	207
*F6FII	"	260,700	605	62	175
*F5NKX	"	251,720	446	72	168
*F5JLV	"	237,748	640	47	149
*F5JOT	"	200,046	502	51	180
*F6ABI	"	194,544	500	55	138
*F5SGI	"	188,055	431	57	142
*F5JDG	"	181,240	451	55	142
*F8BQQ	"	105,799	381	61	180
*F5TVG	"	83,780	236	55	87
*F5MFL	"	82,050	300	34	116
*F6DZD	"	54,784	220	41	87
*F5RPB	"	51,474	172	47	91
*F5MLJ	"	32,548	170	24	55
*F5MNK	"	30,464	132	51	85
*F5ICX	"	26,602	177	18	76
*F8AAN	"	25,125	279	45	80
*F5LBG	"	20,680	220	16	43
*F2FX	"	14,247	68	31	50
*F8BBL	"	13,662	116	34	32
*F5NSO	"	11,935	75	31	46
*F5UB	28	66,576	392	26	50
*F5JY	"	43,296	239	23	59
*F5NLX	"	13,862	100	23	35
*F9DK	21	54,180	334	21	65
*F8CNR	"	6,566	117	14	35
*F/OK1EE	7	159,831	719	27	102

GERMANY

DL2DX	A	1,958,358	1696	150	379
DL6JZ	"	1,730,052	1744	105	393
DJ6QT	"	1,567,800	1508	118	402
DL5YM	"	1,300,277	1523	122	351
DL3YBM	"	1,284,980	1411	110	360
DK5IM	"	1,277,172	1412	106	362
DFØFS	"	1,188,972	1569	88	316
					(Op: DL1EKC)
DJØIF	"	1,098,090	1121	122	376
DL6UNF	"	1,032,510	1206	95	286
DL2MDU	"	837,984	891	111	353
DL8FR	"	824,680	1240	100	289
DL8YR	"	673,560	902	77	283
DJØMDR	"	590,525	851	91	304
DL3ZI	"	586,600	854	101	318
DJ5GG	"	581,356	881	90	314
DF1DV	"	564,261	898	92	289
DL9XY	"	508,167	905	75	244
DL1ZU	"	319,712	523	100	288
DL7RAG	"	276,254	354	95	224
DH2SK	"	272,130	598	67	168
DL6KWU	"	204,300	428	65	115
DL1VDL	"	181,170	316	93	204
DL7BY	"	170,982	474	41	136
DL6AG	"	156,000	322	54	141
DJ8UV	"	155,585	448	54	131
DL4KBS	"	123,579	404	55	144
DL3KWR	"	109,060	322	58	147
DJ1MM	"	101,612	309	42	91
DL6DVU	"	90,270	280	48	105
DL9NCR	"	71,878	240	59	107
DL9YP	"	55,632	296	34	80
DL6BE	"	54,009	241	43	110
DL5JMN	"	42,210	222	31	59
DM3XI	"	31,624	116	54	80
DF5AU	"	15,219	94	25	64
DK8EY	"	11,607	99	25	48
DL1ECG	"	7,040	94	28	36
DL8DTL	"	238	12	6	8
DL1IAO	28	818,432	1852	40	144
DK2GZ	"	450,912	1147	39	129
DK7AN	"	45,136	210	25	66
DL5RBR	"	4,830	61	15	27
DFØCG	21	379,860	1126	37	119
					(Op: DL5JQ)
DLØLR	"	115,780	510	34	106
DJ7AA	14	919,853	2274	40	147
DF9LJ	3.5	263,310	1226	31	103
DL7ON	"	252,585	1262	30	105
DL9NEI	"	91,549	807	16	67
DF8AA	1.8	6,864	147	8	44
DL2KUW	"	3,696	97	7	41
DJ2IA	"	2,376	60	6	30
*DAØFF	A	3,410,784	2533	137	487
					(Op: DL2HBX)
*DF4SA	"	2,452,064	1818	136	472
*DL3JAN	"	1,688,865	1574	119	436
*DK3KD	"	1,250,802	1709	91	287
*DL7QU	"	1,113,545	1263	102	319
*DL2HQ	"	1,086,330	1177	110	380
*DK3YD	"	1,007,293	1214	93	334
*DL5ASE	"	979,700	1236	87	317
*DF6LQ	"	972,072	1218	101	313
*DL5KUD	"	856,449	1000	108	343
*DL3ZAI	"	841,600	1043	90	310
*DL9MRF	"	773,553	1106	80	283
*DL3BRA	"	725,600	1095	86	314
*DL1MAJ	"	693,046	768	91	303
*DF3OL	"	603,855	830	84	321
*DL7IZ	"	592,602	716	103	246
*DM3PKK	"	467,517	775	75	234
*DF6VI	"	462,070	805	75	212
*DFØIT	"	452,598	918	71	242
					(Op: DF6QC)
*DK5JM	"	435,240	894	87	285
*DK7ZH	"	403,790	703	74	197
*DL3JK	"	377,487	630	70	227
*DL1ARJ	"	377,384	743	80	242
*DL7ANQ	"	367,812	660	75	231
*DJ2HH	"	342,780	517	85	263
*DJ2YE	"	301,378	657	60	206
*DL2HX	"	281,625	467	102	273
*DL1TH	"	275,370	741	70	204
*DL8ULO	"	237,600	559	57	168
*DL2ANM	"	234,060	402	52	136
*DL2HRN	"	230,418	533	58	193
*DL5DBH	"	222,158	532	55	171
*DL5NA	"	218,367	502	71	100
*DL4FAY	"	170,690	269	95	243
*DL3DBY	"	162,430	420	50	135
*DL6ZNG	"	153,387	361	69	178
*DF7QK	"	153,202	494	53	164
*DL1LSZ	"	151,656	465	56	157
*DL3DRN	"	143,872	281	100	156
*DL2FDD	"	142,120	352	64	145
*DL1DTL	"	133,584	328	73	169
*DF1QQ	"	128,679	337	52	125
*DL3BZZ	"	126,586	294	59	108
*DL3HSC	"	117,024	340	48	136
*DF1LON	"	114,800	324	53	122
*DF3QG	"	111,134	263	63	118
*DL2RTJ	"	106,500	329	58	155
*DL3KWF	"	101,722	295	51	130
*DL2BUM	"	80,782	266	55	114
*DL2AL	"	78,900	275	43	107
*DL5ST	"	76,796	220	55	91
*DL5DSA	"	73,745	215	69	146
*DH3MG	"	70,800	278	47	153
*DL4AAE	"	49,749	171	39	64
*DL4RCK	"	49,427	221	44	117
*DL5WS	"	47,841	190	35	76
*DH2UL	"	42,940	179	35	78
*DF5ZV	"	36,234	165	40	82
*DK8IOF	"	23,250	217	43	107
*DL4ABR	"	21,276	157	34	74
*DJ9XB	"	10,152	95	21	26
*DJ5KZ	"	10,017	73	22	41
*DK6CQ	"	8,722	77	22	27
*DL4OCM	"	8,536	76	30	58
*DL5CX	"	7,592	49	29	44
*DK8EL	"	6,912	88	31	41
*DF5RF	"	6,815	51	18	29
*DL5FCO	"	6,486	74	18	28
*DL2DSA	"	4,032	32	21	27
*DL6OZ	"	1,800	47	15	25
*DL1LH	28	498,750	1247	40	135
*DJ7IK	"	318,636	825	38	129
*DJ9DZ	"	275,352	755	35	119
*DL1CW	"	130,152	416	31	105
*DL4UL	"	118,250	454	33	92
*DL2ZAV	"	103,170	379	29	85
*DL6UAM	"	96,400	402	24	76
*DL3DTH	"	95,940	356	31	86
*DL8UAT	"	68,773	290	25	72
*DK1HO	"	63,360	244	31	89
*DK5ZX	"	57,798	298	26	52
*DK6HH	"	35,520	242	23	57
*DL2MIH	"	4,350	33	20	30
*DL3ARK	"	4,030	59	11	15
*DL2AXM	"	1,488	30	10	14
*DKØUN	21	267,274	1106	31	88
					(Op: DL6DCX)
*DKØDO	"	235,569	747	36	113
*DL2NEQ	"	16,720	125	18	58
*DL6UBF	14	6,077	40	22	37
*DJ3JB	7	122,686	415	33	115
*DL1EMH	"	96,512	479	27	89
*DL8AKA	"	22,444	219	13	49
*DKØSU	"	3,627	85	11	28
					(Op: DF7SA)
*DL3JRA	"	1,600	41	8	8
*DK7ZT	3.5	884	32	5	21
*DJ3RA	1.8	15,180	262	8	52
*DK2JX	"	4,186	68	8	46
*DL4KUG	"	1,120	46	5	27
*DJ9LJ	"	100	208	9	58

GIBRALTAR

ZB2X	3.5	420,875	2112	30	95
					(Op: OH2KI)

GREECE

*SV1BSX	A	137,046	745	45	137
*SV1JA	"	60,210	223	8	82
*SV1DKL	28	235,950	993	37	113
*SV2BFL	"	80,214	460	28	59
*SV1DKR	21	7,370	165	14	41
*SV/OK1YM	7	187,108	1073	22	94

GUERNSEY

*MU/OH3GI	A	67,116	433	22	80
*2UØARE	"	66,255	268	25	80
*MU /OH9MM	21	411,635	1668	33	100

HUNGARY

HA3LI	A	1,863,490	1773	137	477
HG5T	"	1,754,696	1795	129	419
					(Op: N9NC)
HA3PT	"	454,308	899	90	303
HA5MY	21	535,050	1962	40	134
HAØDU	"	271,928	838	35	117
HG8M	"	55,890	313	23	67
HA3GJ	"	41,877	215	26	73
HG3DX	14	598,210	2168	38	125
					(Op: HA3UU)
HA8RH	"	335,850	1235	37	113
HG1R	"	268,416	1728	35	109
					(Op: HA1DRR)
HG9X	7	547,162	1996	33	121
HA3OV	"	202,623	844	28	109
HA8JV	3.5	289,640	1418	27	103
HA8BE	1.8	96,628	846	19	79
*HA8IC	A	339,515	688	64	188
*HA8AT	"	170,170	362	63	175
*HG8C	28	318,006	938	38	124
					(Op: HA8EK)
*HA8MT	"	207,240	616	37	120
*HA3RG	14	9,918	73	19	39

ICELAND

TF8GX	A	118,190	362	65	200
*TF8SM	A	98,394	344	39	147

IRELAND

EI8IC	28	115,772	508	24	79
*EI4DW	A	844,190	1225	80	210

ISLE OF MAN

*GD4UOL	A	1,770,952	2808	83	299

ITALY

IK1YLL	A	205,446	462	99	254
I6FDJ	"	107,787	398	54	129
IV3RLB	"	92,749	287	54	83
I4DZ	"	66,234	234	42	91
IKØYUT	"	32,190	218	48	97
IK1YEE	"	11,988	137	30	44
IZ1DFI	"	5,782	149	24	74
IZ4COW	"	4,500	35	23	27
IK8YFW	"	1,079	29	7	6
IK4MED	28	421,070	1141	38	120
I8RIZ	"	279,990	906	33	102
			(Op: I7ALE)		
IU2C	"	174,811	670	31	82
IUØPAW	"	140,192	665	28	76
			(Op: IKØSHF)		
IZØAIS	"	102,102	464	30	72
IK4ZHH	"	69,218	320	28	78
IO5Z	"	31,720	244	20	41
			(Op: IZ5AXA)		
IU2X	14	240,751	1003	40	123
			(Op: IK2GSN)		
IK5QQE	"	214,011	1083	33	96
IZ2AHF	"	6,300	83	13	23
II1H	3.5	173,600	1133	22	90
IZ3ALF	"	69,006	622	18	75
*IKØYVV	A	2,439,444	1814	148	530
*I3JSS	"	2,323,517	2314	116	395
*IK1RQQ	"	1,482,286	1659	115	381
*IV3TQE	"	1,086,442	1182	124	373
*IK4EWX	"	735,200	1014	93	307
*IK3ORD	"	379,224	612	69	207
*I4FGG	"	295,260	601	67	218
*IK7JWY	"	273,664	578	72	184
*IK2AIT	"	179,133	444	56	157
*IQ3X	"	172,044	401	71	172
*IK2NCF	"	115,440	297	58	150
*IZØANC	"	99,538	332	45	112
*I4JEE	"	99,294	293	60	187
*IK2WYI	"	99,280	348	38	108
*IN3NOR	"	93,687	311	44	123
*IK2NUX	"	51,069	230	35	52
*IK4SDS	"	44,000	170	41	69
*IZ5BRW	"	40,000	215	30	70
*IK5RLS/2	"	38,612	182	35	63
*IK4NPC	"	18,316	123	27	49
*IK8WEI	"	15,080	101	27	38
*IK3SSJ	"	9,108	169	33	66
*IKØSTM	"	3,534	38	25	37
*IK3SCB	"	2,680	31	16	24
*IV3KSE	"	1,296	26	10	14
*I3MLU	28	105,149	386	30	91
*IQ2X	21	145,768	609	37	96
			(Op: IK2GZU)		
*IK3QAR	"	110,109	467	32	95
*I5OQV	"	19,620	152	18	42
*IK3HUG	14	108,665	698	24	79
*IR2G	"	1,729	40	6	13
*IK8TEO	7	69,834	344	28	85
*IV3KTY	3.5	68,284	673	16	70

JERSEY

MJØAWR	A	2,748,434	3108	107	374

KALININGRAD

UA2FP	A	512,095	1212	64	241
UA2CZ	"	381,609	644	78	249
RA2FB	28	14,637	157	11	30
*UA2FT	14	18,870	119	21	64

LATVIA

YL2KO	A	2,171,018	2038	135	428
YL2MR	"	1,535,222	2149	102	329
YL2IP	"	273,890	396	95	210
YL3CW	28	657,354	1747	38	140
YL2GD	7	229,432	1073	32	104
*YL2GN	A	795,555	1183	89	299
*YL2EC	"	10,296	60	27	39
*YL2UZ	28	120,360	391	26	92
*YL2SW	"	10,224	102	15	33
*YL3FW	14	32,838	293	18	60
*YL2PP	7	60,000	340	21	79
*YL3RW	3.5	11,825	204	7	48
*YL2KA	"	3,196	59	9	38

LITHUANIA

LY6M	A	7,140,784	4634	163	558
			(Op: LY1DS)		
LY2IJ	"	4,082,305	3183	146	473
LY2CY	"	3,966,309	2915	144	513
LY5W	"	3,445,350	2636	156	513
			(Op: LY1DR)		
LY2MM	"	1,617,354	1427	127	422
LY2HN	"	1,517,760	1444	125	419
LY2KM	"	1,007,021	1003	97	386
LY3CI	"	954,960	1171	101	257
LY2DX	"	756,976	1194	82	292
LY1BX	"	25,671	140	41	88
LY2CI	28	537,600	1497	37	131
LY2OX	14	489,868	1530	38	126
LY3BX	7	237,094	1025	32	111
LY2TA	3.5	360,685	1505	37	118
LY3ID	"	87,115	709	19	76
LY2VAD	1.8	90,440	854	19	66
			(Op: LY1FZ)		
*LY3BA	A	2,352,674	2227	115	423
*LY2LA	"	1,567,676	1839	101	350
*LY2GV	"	1,302,980	1466	103	351
*LY1BW	"	827,854	1285	74	285
*LY2FN	"	552,330	973	83	278
*LY1DM	"	204,334	309	79	192
*LY2EC	"	201,803	531	56	171
*LY2PBM	"	165,418	559	45	161
*LY3KB	"	20,064	183	31	83
*LY3JY	28	196,236	577	35	123
*LY3IW	21	100,510	405	28	87
*LY2GW	"	68,646	308	23	79
*LY2FF	"	64,128	347	23	63
*LY2BN	7	133,140	602	29	99
*LY2BLQ	"	110,500	684	26	99

LUXEMBOURG

LX4B	21	580,863	1767	38	130
			(Op: OH2PQ)		
*LX1JH	A	53,938	200	41	108

MACEDONIA

*Z31GB	A	1,850	25	14	23
*Z32MB	28	17,272	106	24	44
*Z31CN	14	140,251	755	32	107

MALTA

*9H1ZA	A	1,539,120	2171	101	339
*9H3MH	"	1,250,914	1936	107	342
			(Op: DJ9MH)		
*9H3J	"	782,323	1846	67	222
			(Op: JF1SQC)		

MOLDOVA

ERØF	21	156,750	1022	30	80
			(Op: UXØFF)		
ERØN	14	529,374	1736	38	128
			(Op: UT7ND)		
ER1LW	3.5	137,700	1320	20	82
ER1CW	"	21,167	366	10	51
*ER5 /UX3FW	28	75,516	568	24	63
*ER2GR	"	11,799	85	17	40
*ER3DX	3.5	52,480	586	12	68

NETHERLANDS

PAØRCT	A	1,587,765	2155	102	351
PA3HBB	"	732,824	1279	85	291
PAØLOU	"	412,290	537	105	300
PAØADP	"	334,312	767	73	246
PAØMBD	"	206,724	387	78	198
PA3CAL	"	208	8	8	8
PAØCLN	1.8	35,719	411	13	69
*PA3BFH	A	980,875	1170	92	321
*PA3EMN	"	778,516	1139	88	294
*PAØMIR	"	753,472	1001	87	299
*PAØJR	"	551,520	808	84	276
*PA3GRM	"	296,934	745	72	170
*PAØHOR	"	202,725	455	73	192
*PA7AA	"	130,625	1356	87	338
*PAØSKP	"	61,793	198	47	104
*PA5GU	"	39,143	367	12	25
*PAØRBS	"	35,280	193	51	96
*PA3BEJ	"	16,632	100	33	75
*PAØJED	28	170,816	562	32	104
*PA3ELD	"	148,461	607	31	92
*PAØQX	21	7,844	209	15	38
*PA3AAV	7	399,828	1379	36	120

NORTHERN IRELAND

GIØKOW	A	6,918,708	4831	163	553
			(Op: GIØNWG)		
GI4KSH	"	227,268	516	57	157
*GI4SNC	A	747,520	1465	65	227

NORWAY

LA7MFA	A	2,225,090	2446	107	371
LA9HFA	"	1,194,024	2026	81	275
LA1YE	"	636,678	980	72	254
LA6IHA	"	392,235	806	74	257
LA6PB	"	313,841	627	68	209
LA9GY	"	88,754	342	56	167
LA2IR	"	77,916	260	41	110
LA1CCA	"	62,426	160	64	118
LA4EU	"	50,439	209	44	85
LA8GK	"	21,708	86	46	62
LA2QM	"	7,068	68	17	21
LA4XT	21	144,004	456	33	106
LA2O	3.5	26,664	426	10	56
*LA2HFA	A	695,640	1041	81	291
*LA1VFA	"	237,314	461	74	179
*LA9WDA	"	54,810	223	40	95
*LA6ZFA	"	28,500	140	30	70
*LA8CE	"	24,480	87	43	53
*LA8PV	"	11,692	60	34	45
*LA9DK	"	5,061	83	9	12
*LA9AU	14	3,825	113	13	32
*LA8WG	1.8	6,727	135	7	49

POLAND

SP7GIQ	A	5,921,220	4479	148	432
3Z4N	"	2,621,328	2195	138	444
			(Op: SP4NI)		
SP8NR	"	1,874,172	1550	129	435
SP3FLR	"	1,001,672	1154	108	326
SP9DAE	"	631,584	1070	73	271
SP2FGO	"	547,528	946	78	278
SP3MGP	"	514,848	798	82	264
SP2IU	"	237,120	471	75	172
SP6GNO	"	227,766	498	64	174
SP2HPM	"	218,535	560	65	190
SP6FVF	"	178,838	340	71	171
SP9FT	"	151,287	341	61	150
SP3CYY	"	101,700	409	57	123
SP6CXH	"	76,038	245	48	90
SP5BNB	"	73,755	216	56	109
SP7BDS	"	17,388	111	32	60
SP3FAR	"	16,119	74	35	46
SP2GKQ	"	4,165	66	13	36
SP8BRQ	28	345,481	900	39	134
SP5DDJ	"	258,390	740	35	110
SP5UAF	"	193,011	542	34	113
SN9R	"	39,270	219	22	48
			(Op: SP9BPR)		
SP9CCA	"	594	34	3	3
SN8V	21	423,450	1505	37	113
			(Op: SP8LBK)		
SP4JWD	"	82,490	310	28	85
SP2FAX	14	974,880	2546	40	140
SP9NLK	7	432,124	1372	35	126
SP3CW	"	88,494	571	19	79
SP9ABU	"	82,917	372	23	88
SP3HRN	3.5	40,014	441	13	68
SN3A	1.8	158,445	1180	22	83
			(Op: SP3HLM)		
SP5JTF	"	10,092	226	8	40
SP6MQO	"	3,783	101	5	34
*SP2QCH	A	1,842,176	1872	119	393
*SN7N	"	1,745,100	1841	121	404
			(Op: SP7NMW)		
*SP1AEN	"	1,153,129	1304	103	396
*SQ9BZK	"	879,208	1326	100	312
*SP3VT	"	632,576	1219	79	274
*SP6CDP	"	477,620	637	90	244
*SP9RTI	"	344,568	561	85	209
*SP8BVN	"	332,592	542	77	251
*SP9GKM	"	325,941	645	58	191
*SP9GFI	"	281,840	590	60	200
*SP7ELQ	"	270,429	496	79	248
*SQ9CAQ	"	239,104	548	60	196
*SP3HC	"	228,375	544	48	127
*SQ2HEB	"	179,332	482	56	158
*SP5ICS	"	178,672	422	52	156
*SP8FHJ	"	165,186	548	63	203
*SP9ADV	"	106,590	291	47	118
*SP9KJU	"	103,180	301	54	100
			(Op: SP9MDY)		
*SP2MKT	"	76,002	240	46	113
*SP2EPV	"	74,630	198	56	114
*SP2DVH	"	71,250	183	54	96
*SQ9DXN	"	67,620	152	69	127
*SP5ASY	"	63,623	180	50	99
*SP5IKC	"	51,121	184	40	69
*SP6NIF	"	50,071	117	58	103
*SP3DBD	"	36,309	99	50	83
*SQ3DWR	"	33,125	215	28	97
*SP5ULV	"	25,988	135	23	50
*SP3XR	"	25,661	331	47	90
*SP8GEY	"	23,280	90	43	54
*SP7ICE	"	15,390	61	34	61
*SQ3VAA	"	5,612	67	14	47
*SP2IHG	"	1,364	60	10	17
*SP5GH	"	1,350	15	15	15
*SP2UKB	28	168,484	485	34	112
*SP3LWP	"	159,704	472	35	149
*SP3LPR	"	133,943	388	35	109
*SP5LCC	"	60,192	246	29	70
*SP2FWC	"	21,170	120	22	51
*SP3AZO	"	17,108	135	18	34
*SP3AOT	"	13,905	116	16	29
*SP5CGN	"	7,344	90	13	23
*SP9XCN	21	368,160	1057	38	118
*SP4TKR	"	202,897	850	36	101
*SP9QJ	"	102,778	365	29	89
*SP8JUR	"	40,290	203	23	79
*SP1BLE	"	26,895	193	16	39
*SP4HHI	"	12,215	167	15	20
*SP8BAB	14	60,137	200	33	88
*SP6RGC	"	1,100	89	7	37
*SP5CNA	7	87,255	461	23	82
*SP9BBH	3.5	74,390	715	14	72
*SP6GCU	"	55,063	591	14	65
*SP5OXJ	"	2,107	27	18	25
*SP6LV	1.8	9,655	193	5	47
*SPØAAZ	"	416	27	2	14

PORTUGAL

CQ1A	28	124,888	533	33	101
*CT1BNW	A	21,760	114	30	50
*CT1GFK	28	134,981	1013	19	58
*CT1FNT	14	4,880	102	10	30

ROMANIA

YO3ND	A	311,629	592	80	201
YO7BGA	"	209,878	431	72	130
YO4ASD	"	22,575	150	40	65
YO4NF	28	485,604	1788	35	106
*YO6BHN	A	982,036	1114	117	367
*YO2DFA	"	727,200	1279	95	309
*YO6MK	"	297,018	616	58	203
*YO3CTK	"	253,340	497	68	197
*YO4ATW	"	73,531	200	50	89
*YO3BWK	"	39,732	100	74	84
*YO8MI	"	34,602	133	48	98
*YO4RHK	"	17,820	252	25	85
*YO8GF	"	6,136	40	23	36
*YO4BTB	"	4,428	46	13	27
*YO4GDP	28	196,995	860	31	84
*YO3FRI	"	190,569	614	35	104
*YO5PBF	"	58,812	261	25	62
*YO9HP	"	14,040	111	23	37
*YO3FF	"	513	11	9	10
*YO5AJR	21	98,770	380	30	89
*YO4BBH	"	96,600	500	24	81
*YO9FJW	7	78,080	693	16	67
*YO2CJX	"	53,000	386	21	79
*YO5DAS	3.5	17,004	301	8	44
*YO5OHO	"	15,390	262	7	47
*YO9AGI	"	14,080	300	7	37
*YO2BEH	1.8	3,382	88	5	33

SARDINIA

ISØGSR	28	76,738	555	21	53
*ISØIGV	A	393,650	697	71	239
*ISØHQJ	"	300,858	712	67	179
*ISØLDT	"	28,792	153	33	89
*ISØ /YO3RA	28	195,624	759	37	115
*ISØSDX	"	63,070	386	25	60

SCOTLAND

*GM4SID	A	1,038,597	1469	91	320
*MMØBQI	"	54,776	259	43	121
*GM3CFS	28	154,810	516	31	106

SICILY

IT9VDQ	A	40,248	146	40	89
IT9BLB	1.8	78,020	757	16	78
*IT9GSF	A	8	2	2	2
*IT9AF	21	139,440	899	29	91

SLOVAK REPUBLIC

OM3OM	A	1,213,488	2038	100	324
OM7IR	21	99,412	413	26	90
*OM8ON	A	985,208	943	114	368
*OM5AW	"	894,159	1650	95	304
*OM4DN	"	682,077	1079	84	279
*OM7AG	"	516,530	1038	65	249
*OM8DD	"	495,327	1044	71	238
*OM8FF	"	453,684	949	72	236
*OMØTT	"	443,348	801	71	245
*OM3BA	"	316,166	600	65	224
*OM1AF	"	294,555	833	54	215
*OM3CDZ	"	201,376	598	49	183
*OM6TX	"	191,648	493	56	156
*OM3CAE	"	82,931	328	38	89
*OM1DG	"	76,986	220	51	131
*OM7VF	"	68,150	234	47	98
*OM1ADM	"	49,468	226	43	106
*OM7RC	"	46,827	219	27	94
*OM8CD	"	25,452	216	36	90
*OM7AT	"	22,168	138	23	61
*OM5UM	"	15,470	136	31	54
*OM5KM	28	49,416	165	31	85
*OM7YC	"	10,505	75	19	36
*OM7PY	21	55,658	229	26	89
*OM5AR	14	49,815	406	17	81
*OM4WW	7	57,036	350	20	77
*OM3TJT	"	28,356	260	15	53
*OM3ZWA	3.5	8,103	455	12	61

SLOVENIA

S58A	A	6,203,967	3989	171	582
S5ØA	"	5,148,900	3602	166	509
S55A	"	1,232,496	1267	125	361
S51AY	28	594,828	1381	40	146
S57C	"	541,493	1485	38	119
S5ØK	"	460,496	1539	35	101
S53Ø	"	444,448	1221	40	132
S5ØQ	"	420,358	1392	35	99
S51B	"	296,040	1114	30	90
S56M	21	522,822	1619	36	122
S5ØR	"	393,600	1341	40	124
S59A	7	863,028	2274	40	143
S57AL	"	614,955	1852	38	127
S57Z	"	161,694	796	25	92
S54W	3.5	134,976	981	22	92
S53F	"	80,367	782	15	74
S5ØU	1.8	119,600	995	20	84
S57M	"	95,933	949	19	78
*S59AA	A	3,120,620	2218	154	520
*S57U	"	1,370,808	1377	110	364
*S54AA	"	1,005,712	1021	114	412
*S54X	"	961,800	1161	101	319
*S53XX	"	725,402	1212	83	300
*S51W	"	326,808	1100	39	114
*S57XX	"	188,079	364	69	144
*S53AU	"	28,558	132	32	77
*S58DX	28	124,392	471	34	108
*S5ØN	21	380,856	1133	39	129
*S51RJ	"	223,782	724	37	114
*S57DX	7	494,431	1579	37	124
*S54A	"	234,150	897	34	116
*S59KW	"	219,583	1053	26	101
*S52GO	3.5	57,780	539	17	73
*S53MJ	1.8	7,379	193	6	41

SPAIN

EA5FV	A	2,960,808	3386	108	348
EA2IA	"	2,443,258	3387	118	364
EA3BOW	"	353,682	775	73	221
EA1OJ	"	113,520	236	69	146
EA4IL	"	76,020	241	47	93
EA5TD	"	43,076	142	46	132
EA5AVC	"	42,900	163	54	89
EA1AAA	"	21,756	95	40	58
EC5AID	"	21,109	155	26	75
EA7TG	"	14,157	60	42	57
EA3GIS	"	12,640	98	33	46
EA5ARC	"	4,393	68	13	10
EA3AQQ	"	375	15	11	14
EA1FEL	28	229,500	848	33	102
EA7AKJ	"	99,360	448	28	80
EA1JO	21	193,664	663	32	104
EA3BHK	"	167,500	638	34	100
EA3AEK	"	52,326	302	26	88
EA1FBU	7	42,126	538	14	45
EA7GSU	3.5	46,284	359	15	87
*EA2BNU	A	969,289	1316	90	301
*EA5YU	"	793,848	1127	88	300
*EA2AZ	"	784,160	1129	85	292
*EA7AJR	"	652,492	1173	77	237
*EA1BXW	"	615,330	872	77	241
*EA2BDS	"	384,300	860	64	180
*EA7GXX	"	231,336	470	63	141
*EA1FBJ	"	200,928	599	57	167
*EA5LA	"	170,382	380	65	154
*EA4BSC	"	110,271	230	78	189
*EA1CS	"	107,030	300	50	104
*EA5FJD	"	97,728	373	49	143
*EA7FZ	"	83,226	280	44	99
*EA1FAE	"	60,192	182	55	116
*EA7CA	"	58,806	167	59	103
*EA4AQT	"	48,888	220	35	91
*EA2CAR	"	44,690	198	33	76
*EA5AFH	"	42,822	160	55	128
*EA7GVW	"	33,562	150	35	62
*EA4OA	"	32,364	169	38	86
*EA1FB8	"	31,096	146	37	67
*EA1EVR	"	27,720	283	16	44
*EA4AES	"	13,482	86	25	38
*EA5EDN	"	9,180	81	19	35
*EA1DFP	"	6,667	43	20	39
*EA4BNQ	"	792	30	4	14
*EA7ASZ	28	154,671	590	29	100
*EA7OO	"	95,500	480	24	76
*EA5ABH	"	21,128	135	26	50
*EA4AHD	21	122,544	811	22	70
*EA7IL	14	92,929	731	19	54
*EA5AWI	"	90,797	525	27	92
*EA4BWR	"	27,888	343	19	64
*EA1ND	"	20,435	240	18	43
*EA3AR	3.5	14,212	248	7	37
*EA7AIN	1.8	1,020	24	6	24

SWEDEN

7S5A	A	2,155,136	2620	121	331
			(Op: SM5CEU)		
SM5CLE	"	1,023,120	1187	100	320
SM7EH	"	535,131	750	81	252
SM6WQB	"	379,130	728	71	239
SMØNZZ	"	121,914	365	58	176
SM7BVO	"	111,800	322	46	84
SM6CST	"	80,910	275	38	107
SK7AX	"	41,455	165	45	90
			(Op: SM7HCW)		
SM5RE	"	25,956	263	31	96
SM7BQX	"	20,400	109	34	66
SM2EKM	28	921,193	2214	40	151
7S5Q	"	305,394	1086	33	105
			(Op: SM5COP)		
SM5AD	"	138,782	329	36	125
8SØA	21	453,071	1443	38	129
			(Op: SMØDJZ)		
SMØKV	"	282,315	853	37	128
SMØDRD	14	252,108	897	37	112
SKØUX	7	583,814	1869	37	117
			(Op: SM3UZS)		
7S6W	"	209,336	938	31	106
7S2E	3.5	159,000	1171	24	96
			(Op: SM2DMU)		
SK3LH	"	7,686	136	8	34
			(Op: SM3WMV)		
SM6DOI	1.8	23,870	446	13	57
*SM5G	A	1,253,779	1468	89	342
			(Op: SM5JBM)		
*SM2T	"	1,249,408	1618	105	349
			(Op: SM2EZT)		
*SM6BSK	"	683,055	894	91	296
*SM2KAL	"	663,148	1124	95	291
*SMØBDS	"	614,422	875	83	278
*SM7BHM	"	524,970	914	73	269
*SM2ODB	"	457,932	993	91	281
*SM4SX	"	406,224	686	66	182
*SMØJ	"	305,760	600	73	207
*SM7CIL	"	217,532	450	58	180
*SM7BJW	"	159,692	426	51	115
*SM3CBR	"	110,424	291	68	146
*8SØW	"	66,456	284	79	155
			(Op: SMØNJO)		
*SM6WXO	"	60,858	319	39	99
*SM3AVW	"	59,280	178	46	110
*SM6AOU	"	49,926	121	61	96
*SM7CWI	"	41,904	183	42	102
*SM7TKL	"	24,640	145	37	75
*SM5HIH	"	2,160	50	11	29
*SM3X	28	258,020	688	51	139
			(Op: SM3CVM)		
*SM3D	"	78,088	596	25	61
*8S7X	21	286,380	940	34	114
			(Op: SM7UTP)		
*SM6N	14	113,105	622	28	88
			(Op: SM6NJK)		
*8S3A	"	31,376	211	20	54
			(Op: SM3DXC)		
*SM6JY	"	24,640	202	20	50
*SM7GXR	7	45,212	300	18	71
*8S6A	"	25,908	277	13	55

SWITZERLAND

HB9FAP	A	1,094,875	1157	136	339
HB9FBS	"	455,088	1148	68	236

HB9IAL	*	13,377	97	27	64
HB9HFN	*	12,337	59	30	43
HB9DDZ	7	19,100	87	24	76
***HB9ARF**	**A**	**1,285,380**	**1487**	**97**	**347**
*HB9CBR	*	401,289	680	78	213
*HB9CVO	*	230,000	450	68	182
*HB9RE	*	51,084	209	39	60
*HB9DOT	*	6,780	55	23	37
*HB9HQX	28	16,800	153	17	43
***HB9APJ**	**1.8**	**7,524**	**252**	**5**	**39**

UKRAINE

UX7IA	**A**	**2,431,765**	**2546**	**129**	**466**
UR3QCW	**"**	**926,280**	**1024**	**104**	**361**
UX3ZW	*	696,541	969	103	330
UX7QQ	*	503,625	540	102	323
UR6IJ	*	328,095	609	80	237
UR6QS	*	158,175	414	44	141
UUØJX	*	134,974	291	82	135
UY5YY	*	90,396	242	56	130
UT5JAP	*	89,585	182	69	136
UU2JZ	*	87,636	295	44	90
UT3QT	*	70,192	165	59	105
UR4VA	*	61,628	300	36	106
UU4JQE	*	22,814	155	34	88
UT5HP	*	16,137	78	39	60
UT7UW	*	15,035	63	37	60
UT5UGQ	*	750	14	12	13
EM8I	**28**	**192,725**	**796**	**31**	**107**
			(Op: UT8IM)		
UX5UO	**"**	**185,712**	**568**	**35**	**111**
UR3IOB	*	148,400	473	35	105
UT2ID	*	137,196	576	36	112
UR5ZEL	*	104,129	317	34	103
UT4EK	*	68,805	324	25	74
UX2FXX	*	54,366	321	25	57
			(Op: UR5FGN)		
UR5WCW	**21**	**182,204**	**488**	**39**	**125**
UX3HA	*	66,976	365	26	66
US0MR	**14**	**98,805**	**617**	**30**	**75**
UU1JO	*	31,816	240	18	64
US5WE	**7**	**602,140**	**1770**	**39**	**131**
UX1UA	**"**	**501,981**	**1616**	**31**	**118**
UY5QQ	*	435,480	1494	35	117
US2IR	*	392,418	1397	39	130
UX2MM	*	297,432	1162	34	119
UR7QM	*	136,141	725	24	85
UT4NW	*	79,768	331	24	94
UT9F	**3.5**	**158,771**	**1001**	**25**	**93**
			(Op: UR5FCZ)		
US2IZ	*	80,898	678	18	79
UY2UZ	*	54,219	472	18	75
UR3QT	*	51,840	530	15	66
***US3IZ**	**A**	**602,962**	**862**	**98**	**326**
***UT4UM**	**"**	**590,010**	**951**	**86**	**340**
***UR9MM**	**"**	**523,032**	**1020**	**77**	**295**
*UY5ZZ	*	500,864	955	89	255
*US9QA	*	481,983	915	89	258
*UY5TE	*	445,550	883	69	266
*UT8IT	*	354,246	644	71	231
*UY4LI	*	293,813	770	57	176
*UT4XU	*	230,864	475	73	234
*UY5WA	*	155,338	485	44	158
*UY2RO	*	142,560	335	60	204
*UX2RY	*	65,221	159	59	114
*UR5ZRK	*	29,715	160	23	82
*UU9JWI	*	23,312	89	44	80
*UR7QJ	*	12,980	78	26	33
*UR5EIT	*	12,807	122	40	86
*US8MX	*	4,293	95	30	51
***EO1I**	**28**	**247,040**	**1049**	**30**	**98**
			(Op: UT1IA)		
*UT1FA	*	116,607	344	36	105
*UX3MO	*	76,941	392	31	72
*UR4QOS	*	69,252	437	23	64
*UT3FM	*	59,360	253	27	79
*UT3UZ	*	56,814	255	27	75
*UU4JNY	*	7,380	58	20	40
*UR3PFJ	*	5,520	78	12	15
***UR8RF**	**21**	**134,696**	**469**	**37**	**115**
*UX5EF	*	101,315	405	31	84
*UR5TAU	*	55,247	292	30	71
*UR5MKD	*	44,460	258	23	67
***EN1I**	**14**	**316,800**	**1191**	**36**	**124**
			(Op: US1ITU)		
*UT7EG	*	50,140	376	19	73
*UY3QW	*	44,311	512	17	56
*UY5YA	*	21,138	166	18	60
*UT3EK	*	9,230	86	14	51
***UR4III**	**7**	**29,716**	**206**	**21**	**55**
***UR3PDT**	**3.5**	**56,056**	**518**	**15**	**76**

WALES

GW3KDB	**A**	**752,388**	**814**	**112**	**395**
GW3YDX	**28**	**990,120**	**2444**	**40**	**145**
GW3JXN	**21**	**388,088**	**1325**	**35**	**104**
***GW3NJW**	**A**	**943,008**	**1402**	**84**	**292**
***GW3SYL**	**"**	**719,394**	**1032**	**86**	**315**
*GW3KJN	"	155,530	427	53	153
*GWØKZW	*	52,083	253	31	62

YUGOSLAVIA

4N9BW	**A**	**5,269,900**	**3960**	**153**	**545**
			(Op: YU7BW)		
YZ9A	**28**	**678,600**	**1679**	**39**	**135**
			(Op: YU1NW)		
4N1N	*	223,080	670	30	113
			(Op: 4N1LB)		
YU1RE	*	131,412	461	35	106
YU7SF	*	98,252	342	30	86
YT7KF	**21**	**624,242**	**1911**	**39**	**122**
YU1KX	*	445,315	1434	39	130
YU7FN	**14**	**12,078**	**109**	**14**	**47**
YT7A	**7**	**468,022**	**1770**	**36**	**133**
			(Op: 4N7DW)		
YT1BB	*	424,528	1744	35	122
YZ6A	**3.5**	**178,365**	**1226**	**26**	**89**
YU1KR	*	125,208	1064	19	75
YT1V	*	120,736	844	22	90
YU1EXY	**1.8**	**20,090**	**391**	**10**	**60**
***YU7WJ**	**A**	**1,360,348**	**1524**	**101**	**372**
*YU7LS	*	298,506	552	81	186
*YU1QU	*	139,416	386	46	111
***YU7WW**	**28**	**344,396**	**1048**	**36**	**112**
***YU1OJ**	**"**	**306,384**	**1000**	**36**	**120**
*YT1MP	*	212,076	695	36	115
*YUØC	*	78,750	349	27	78
			(Op: 4N7CA)		
*YU7KM	*	71,757	268	33	86
***YTØC**	**21**	**508,546**	**1390**	**40**	**138**
			(Op: YU7CB)		
*4N1FG	*	169,752	696	32	100
*YU1QW	*	101,556	396	30	87
***YU1HFG**	**14**	**160,776**	**986**	**28**	**98**
			(Op: 4N1FTD)		
*YZ1EZ	*	62,150	398	30	83
***YZ7ED**	**7**	**258,150**	**1149**	**33**	**117**
*YU1EA	*	200,046	846	34	120
*4N7A	*	90,720	508	23	89
			(Op: YT7KM)		
*YU1FG	*	41,820	281	17	65
*YU1JW	*	2,025	74	9	36
***YU1YV**	**3.5**	**64,032**	**551**	**16**	**80**
***YU1CC**	**1.8**	**18,550**	**290**	**7**	**55**
*YU1AST	*	6,864	122	7	41
			(Op: YZ1EA)		

OCEANIA

AUSTRALIA

VK2IA	**A**	**2,312,019**	**1789**	**135**	**342**
VK8AV	"	1,372,572	1196	123	303
VK4EMM	**14**	**704,184**	**1707**	**35**	**113**
VK5GN	**3.5**	**21,960**	**154**	**23**	**38**
***VK7WB**	**A**	**119,658**	**286**	**63**	**91**
			(Op: W6FA)		
*VK4XW	*	5,616	36	24	28
***VK4ICU**	**28**	**170,746**	**536**	**32**	**86**
*VK4TT	14	33,894	170	22	41
*VK2BNG	*	28,194	165	25	49
***VK3TZ**	**3.5**	**12,095**	**129**	**18**	**23**

EAST MALAYSIA

9M6NA	**A**	**7,402,265**	**4211**	**169**	**442**
			(Op: JE1JKL)		
9M8YY	**21**	**620,964**	**1523**	**35**	**106**
			(Op: JR3WXA)		

GUAM

KH2/K4ANA	**A**	**1,297,115**	**1670**	**100**	**195**
KH2/N2NL	**3.5**	**261,352**	**939**	**28**	**76**
*KH2D	A	34,850	157	39	43

HAWAII

KH7R	**28**	**1,420,825**	**3152**	**38**	**123**
			(Op: KH6ND)		
AH7DX	**21**	**986,030**	**2335**	**38**	**113**
KH7Q	**14**	**553,410**	**1550**	**35**	**94**
			(Op: KH7U)		
KH6CC	**1.8**	**41,616**	**408**	**15**	**19**
AH6OZ	*	8,866	198	14	12
***WH6DGA**	**28**	**79,470**	**346**	**29**	**61**

INDONESIA

YBØUNC	**A**	**642,488**	**906**	**100**	**198**
YB5QZ	*	429,006	853	80	174
YBØAVK	**28**	**324,650**	**786**	**37**	**114**
YCØLOW	1.8	100	12	4	8
***YB2UU**	**A**	**1,576,422**	**1916**	**97**	**236**
*YB1SSG	*	34,768	169	45	61
*YC8UFF	*	22,536	217	20	16
***YC8TXW**	**21**	**63,492**	**487**	**23**	**21**
*YB2UDH	14	19,725	111	24	51
*YB1KOR	*	18,270	119	26	64

MARSHALL ISLANDS

***V73CW**	**A**	**1,922,760**	**2274**	**118**	**197**

MINAMI TORISHIMA

***JD1BIC**	**A**	**129,648**	**802**	**51**	**60**

NEW CALEDONIA

***FK8HC**	**28**	**661,055**	**1659**	**35**	**110**

NEW ZEALAND

ZL6OH	**A**	**2,213,710**	**2090**	**119**	**267**
			(Op: ZL1AZE)		
ZL3JT	**28**	**71,295**	**323**	**29**	**76**
***ZL2AL**	**A**	**393,952**	**699**	**74**	**134**

NORTHERN MARIANAS

KHØCE	A	1,610	53	25	21
WHØV	**28**	**355,264**	**1092**	**35**	**87**
NHØE	**21**	**336,875**	**1016**	**35**	**90**

PHILIPPINES

DU3NXE	**A**	**368,212**	**713**	**75**	**119**
DU1ODD	28	18,816	205	21	43
***4F1RWW**	**A**	**1,100,682**	**1381**	**102**	**195**
***DU1ODX**	**21**	**151,281**	**462**	**34**	**83**
***4F2KWT**	**14**	**79,622**	**395**	**28**	**54**

SOLOMON ISLANDS

***H44MX**	**A**	**3,715,320**	**3043**	**136**	**284**
			(Op: K1XM)		

SOUTH AMERICA

ARGENTINA

LU9APM	**A**	**91,938**	**588**	**21**	**45**
LU7YS	*	87,710	336	41	57
LU4AXV	*	58,520	271	40	55
LU/OHØWW	*	32,994	126	35	59
			(Op: OH1EB)		
LU1XS	*	11,147	102	25	46
LT5F	**28**	**1,029,078**	**2837**	**35**	**118**
			(Op: LU4FPZ)		
LU6UO	*	537,044	1672	31	93
LU7AWP	*	499,488	1455	35	94
LU5CW	*	270,972	838	30	87
AY1I	**21**	**1,317,400**	**2833**	**37**	**138**
			(Op: LW9EUJ)		
LT1F	**14**	**713,236**	**2191**	**37**	**127**
			(Op: LU9AY)		
LO1F	*	391,552	1497	34	94
			(Op: LU1FAM)		
***LU1EWL**	**A**	**901,424**	**1310**	**84**	**175**
***LU1AEE**	**"**	**657,408**	**1247**	**67**	**147**
*L5ØV	*	285,239	746	54	97
*LU7DIR	*	198,015	428	71	144
*LU5GPL	*	54,780	179	38	72
***LU3HIP**	**28**	**407,216**	**1272**	**31**	**93**
*LU4FAK	*	11,336	80	19	33
*LW8EXF	*	3,552	40	17	20
***LU5FF**	**21**	**373,375**	**1122**	**36**	**109**
*LU1FNH	*	308,050	1099	33	89
*LU1BW	*	25,900	128	24	50
*LO7H	*	18,576	188	16	38
			(Op: LU7HN)		
*LU3EAQ	*	15,687	92	21	42
***LW2EU**	**14**	**119,900**	**380**	**31**	**78**
*LU3DSI	7	11,475	95	15	30
*LU7DW	3.5	450	21	7	8

ARUBA

P4ØE	**A**	**13,577,850**	**6720**	**177**	**538**
			(Op: CT1BOH)		
*P43JB	28	15,000	196	21	54

BRAZIL

ZZ2Z	**A**	**1,047,480**	**1210**	**101**	**247**
			(Op: PY2YP)		
PY7OJ	*	81,344	217	56	108
PY2FUS	*	2,006	28	16	18
ZX5J	**28**	**2,131,942**	**3962**	**39**	**152**
			(Op: N6TJ)		
PX2A	*	832,662	1965	40	127
			(Op: PY2QE)		
PY4OD	*	196,262	552	30	91
ZW2T	*	107,680	489	23	57
			(Op: PY2TI)		
PQ5W	**21**	**1,071,725**	**2568**	**37**	**126**
			(Op: IV3NVN)		
ZX1Z	**7**	**60,630**	**291**	**22**	**64**
			(Op: PY1LVF)		
*PY1NX	*	828,447	1135	87	184
PY3PAZ	**3.5**	**357**	**33**	**9**	**8**
***ZV2A**	**A**	**875,784**	**1293**	**84**	**189**
			(Op: PY2QI)		
***PY1NX**	**"**	**828,447**	**1135**	**87**	**184**
***PY7IQ**	**"**	**765,555**	**888**	**94**	**223**
*PY1KS	*	753,414	769	138	260
*PY2NY	*	727,980	1181	74	146
*PY5BLG	*	433,165	727	67	138
*PU2WIF	*	203,984	416	62	114
*PR2W	*	167,830	478	42	88
			(Op: PT2AW)		
*PY4FQ	*	155,100	308	79	141
*PP7CW	*	117,034	253	54	109
*PP7CI	*	111,699	224	61	128
*PY2TNT	*	84,000	280	30	70
*PR2CW	*	31,482	111	40	66
			(Op: PY2GG)		
*PY4ZF	*	22,500	168	15	30
*PY7YL	*	19,176	93	42	60
*ZW2B	*	18,352	89	32	42
*PY2NZR	*	8,000	125	23	54
*PY7BEL	*	729	22	13	14
*PY4CEL	*	100	7	5	7
***PY2YU**	**28**	**193,998**	**487**	**36**	**113**
*PY2MTF	*	1,600	21	12	14
*PY2APQ	21	48,396	238	19	55
*PY3FBI	*	29,093	213	19	28
*PY2ABU	*	7,120	68	14	26
*PY2FKD	7	16,896	40	11	16

CHILE

CE3BFZ	**28**	**184,705**	**781**	**28**	**57**
***CE3AA**	**A**	**2,685,690**	**2610**	**114**	**264**
			(Op: XQ3IDY)		

COLOMBIA

HK6KKK	**A**	**2,207,196**	**2250**	**112**	**316**
HK1HHX	**7**	**501,599**	**1646**	**33**	**98**
***HK3JBR**	**A**	**1,688,301**	**2211**	**93**	**234**
			(Op: F2JD)		
***HK3YH**	**28**	**278,860**	**693**	**33**	**113**

FERNANDO DE NORONHA

PYØZFO	**28**	**1,104,080**	**2710**	**35**	**113**

GALAPAGOS ISLANDS

HC8N	**A**	**14,626,579**	**7001**	**185**	**546**
			(Op: N5KO)		

PARAGUAY

ZP6CW	**28**	**71,060**	**297**	**25**	**60**

TRINIDAD & TOBAGO

9Y4VU	**21**	**1,385,976**	**2841**	**39**	**133**
9Y4TBG	**7**	**354,166**	**1022**	**27**	**95**
			(Op: DL4MEH)		

URUGUAY

CX3CY	A	30,470	274	22	33
***CX5AO**	**28**	**1,082,390**	**2347**	**37**	**133**
*CX2AM	*	434,528	1299	35	113
***CX9AU**	**14**	**580,320**	**1427**	**35**	**109**

VENEZUELA

YV7QP	**28**	**79,443**	**610**	**28**	**69**
YV4A	**14**	**307,280**	**1035**	**31**	**84**
			(Op: OHØXX)		
*YV5NWG	A	2,812	29	13	25

MARITIME MOBILE

*UA2FM/MM	A	143,835	296	81	142
***YL3IZ/MM**	**14**	**572,280**	**1280**	**37**	**115**

QRP

P4ØW	**A**	**5,024,800**	**3277**	**137**	**413**
			(Op: W2GD)		
LY2FE	**"**	**1,379,329**	**1537**	**99**	**370**
VE3KZ	**"**	**1,349,316**	**1184**	**111**	**333**
HA2A	**"**	**1,320,662**	**1526**	**91**	**343**
YT7TY	**"**	**1,221,597**	**1382**	**106**	**371**
K1RC	**"**	**953,670**	**847**	**98**	**317**
SM3C	**"**	**944,168**	**1193**	**96**	**332**
			(Op: SM5CCT)		
RA9SO	**"**	**902,761**	**903**	**88**	**317**
N3BJ/4	**"**	**901,296**	**863**	**89**	**307**
JR4DAH	**"**	**861,120**	**906**	**117**	**243**
HA5BSW	**"**	**856,826**	**1516**	**104**	**278**
N8ET	**"**	**809,992**	**763**	**109**	**303**
NØKE	**"**	**784,080**	**818**	**109**	**254**
N7IR	**"**	**748,071**	**705**	**116**	**271**
JA6GCE	**"**	**688,974**	**769**	**121**	**244**
N1TM	**"**	**687,492**	**766**	**83**	**255**
YU1LM	**"**	**658,086**	**1145**	**83**	**271**
W6JTI	**"**	**624,530**	**667**	**113**	**233**
N9CIQ	**"**	**497,169**	**562**	**89**	**244**
G4ELZ	**"**	**468,948**	**812**	**63**	**249**
WA3NKO/4	**"**	**462,927**	**557**	**79**	**234**
IØZUT	**"**	**443,704**	**753**	**69**	**227**
RZ6HX	**"**	**439,570**	**817**	**95**	**294**
UA4YJ	**"**	**421,648**	**752**	**85**	**276**
UA3AD	*	421,120	669	83	237
S52P	**"**	**417,360**	**882**	**67**	**215**
W6YJ	**"**	**416,160**	**521**	**115**	**225**
OE3BCA	**"**	**409,174**	**707**	**91**	**239**
UAØKCL	**"**	**404,246**	**691**	**74**	**154**
UA1OZ	"	403,648	677	89	282
N9AW	*	358,632	476	87	206
K3WWP	**"**	**352,240**	**495**	**68**	**191**
DK5RK	**"**	**341,415**	**680**	**70**	**211**
N4IJ	*	338,750	550	72	199
EA7AAW	**"**	**318,208**	**711**	**54**	**172**
DJ3OE	*	316,332	601	62	199
SP2EWQ	**"**	**313,499**	**597**	**59**	**192**
WA6TLA	*	307,381	405	88	189
N6ZS	*	303,930	371	103	204
S59D	*	290,988	698	85	269
DL5CL	*	283,662	687	69	240
AA1CA	*	269,280	415	80	208
UT5UUF	**"**	**264,936**	**714**	**54**	**195**
K2DW	**"**	**250,525**	**434**	**78**	**197**
PAØADT	**"**	**249,956**	**570**	**57**	**169**
VE7CFD	**"**	**218,720**	**664**	**69**	**91**
			(Op: VE7CQK)		
I3BBK	*	216,104	567	57	170
YL2TW	**"**	**206,245**	**353**	**69**	**178**
W4ZGR/1	*	177,625	341	49	154
GM4HQF	**"**	**152,066**	**522**	**40**	**99**
DK4CU	*	145,642	600	46	156
NØUR	*	134,268	300	46	121
YO4AAC	**"**	**132,405**	**432**	**46**	**149**
US6EX	*	129,732	357	63	165
JA5CDL	**"**	**121,574**	**304**	**70**	**108**
HB9AYZ	**"**	**120,270**	**363**	**45**	**145**
JA5DIM	*	116,270	286	61	90
N2PK/4	*	114,935	259	48	133
SM5DQ	*	111,444	317	56	166
WO9S	*	109,248	216	64	128
C6A					
/WA3WSJ	**"**	**103,424**	**482**	**37**	**64**
GØWAT	*	97,364	396	48	154
N1MT	*	96,875	237	34	121
W9PNE	*	95,226	213	58	119
VE3KQN	*	93,050	118	26	62
US8UA	*	86,000	260	51	149
WD3P	*	85,656	199	44	128
OK2PLK	**"**	**80,660**	**335**	**42**	**143**
RW3TA	*	76,840	261	40	116
DL1LAW	*	76,384	365	39	127
JG2LGM	**"**	**73,875**	**210**	**46**	**79**
JH1XUZ	**"**	**72,576**	**197**	**52**	**92**
DK3RED	"	70,140	312	47	120
7K1CPT/1	*	69,908	206	55	74
IK3JLS	*	65,860	180	52	96
KQ6ES	*	64,106	198	58	75
RV9COI	*	60,882	187	42	104
K7GS	*	60,003	187	35	152
HP1AC	**"**	**59,598**	**187**	**49**	**77**
K2JT	*	56,816	148	40	94
NQ7X	*	53,111	160	58	115
SP4TBM	*	50,660	197	44	105
RUØAT	*	40,673	230	25	64
VE2ABO	*	34,799	169	32	57
AF9J	*	33,335	122	41	72
DJ5QK	*	31,920	162	38	95
DL5CD	*	31,719	227	30	79
DJ1YFK	*	31,518	166	30	73
OK1AIJ	*	31,096	218	28	76
JK1FKN	*	27,615	107	41	64
ON7CC	**"**	**23,040**	**155**	**28**	**62**
W2JEK	*	21,965	84	49	66
GØSAH	*	19,548	132	30	78
UA3UNP	*	18,630	192	19	71
EA7HCB	*	16,827	119	29	50
JN2FSE	*	16,728	83	42	60
K5OI	*	14,476	115	43	51
K7TQ	*	12,717	116	30	51
RW4CG	*	11,904	95	19	43
GØKZO	*	10,920	116	27	57
OM3CUG	*	9,900	55	30	45
Z31GX	*	8,190	74	20	43
YO4CSL	*	6,099	164	36	91
DHØJAE	*	6,083	77	28	51
PAØRBO	*	5,865	63	15	36
AB8DF	*	5,695	68	19	48
US3QW	*	5,280	41	23	37
DL4SZ	*	4,982	59	19	34
RZ4AA	*	4,971	97	16	49
K6MI	*	4,080	63	30	30
N7KT	*	3,186	36	27	32
KH6B	*	3,034	32	19	18
G3HKO	*	2,376	45	30	36
EU6TV	*	1,925	22	13	22
KB3WK	*	616	22	16	16
RV6AF	*	40	153	95	39
LU7EE	**28**	**431,060**	**1144**	**33**	**107**
JR3RWB	**"**	**206,336**	**607**	**35**	**93**
OH7FF	**"**	**130,800**	**591**	**27**	**82**
VE3SMA	**"**	**111,870**	**386**	**25**	**88**
K7ED	**"**	**85,783**	**280**	**30**	**79**
			(Op: WAØRJY)		
EW6DX	**"**	**81,925**	**296**	**28**	**85**
UA9YC	**"**	**77,175**	**316**	**26**	**79**
LY1DT	**"**	**67,968**	**324**	**28**	**90**
LZ2RS	**"**	**63,410**	**268**	**30**	**55**
JA1AA	**"**	**55,742**	**224**	**32**	**62**
NN9K	**"**	**54,777**	**278**	**24**	**69**
9A2EY	**"**	**53,460**	**283**	**23**	**67**
JA2UFH	**"**	**51,903**	**241**	**26**	**53**
HAØGK	**"**	**51,405**	**296**	**19**	**50**
MØO	**"**	**27,328**	**260**	**16**	**48**
KA8NRC	**"**	**25,275**	**124**	**20**	**55**
YT1CS	*	24,570	180	20	50
K7RE	*	22,914	160	18	39
RW4CAM	*	17,262	144	16	47
OK1DCP	*	5,530	71	15	20
EC5ACA	*	3,744	66	13	23
DL2TM	*	2,592	36	11	13
NA4CW	**21**	**171,210**	**475**	**31**	**99**
ES1CW	**"**	**137,607**	**439**	**36**	**121**
7K4QOK	**"**	**121,200**	**391**	**33**	**87**
JE1BDC	**"**	**108,587**	**412**	**32**	**71**
KØEO/6	**"**	**81,620**	**283**	**30**	**80**
			(Op: W8QZA)		
EA3CKX	**"**	**70,488**	**266**	**32**	**100**
ES1CR	*	69,871	322	28	79
W4DEC	**"**	**53,452**	**236**	**24**	**68**
OH2YL	**"**	**29,700**	**180**	**20**	**46**
JL3SBE	**"**	**28,938**	**167**	**28**	**50**
K8UCL	**"**	**22,400**	**115**	**18**	**52**
SQ4GXO	**"**	**21,120**	**178**	**13**	**53**
OK1AQW	"	19,494	127	16	30
HB9LDO	*	770	15	9	13
KR2Q	**14**	**208,392**	**480**	**35**	**117**
G3LHJ	**"**	**108,756**	**563**	**26**	**82**
DF4ZL	**"**	**101,268**	**496**	**28**	**88**
M2H	**"**	**72,001**	**456**	**21**	**68**
			(Op: GØOGN)		
9A3GU	**"**	**39,949**	**265**	**19**	**72**
K4GEL	**"**	**26,936**	**127**	**16**	**58**
S59AV	**"**	**26,424**	**247**	**16**	**56**
DL4OBJ	*	23,725	219	13	52
YU1QQ	**"**	**22,080**	**260**	**18**	**62**
JA2HUN	**"**	**20,060**	**109**	**26**	**42**
W9FHA	*	6,765	58	16	39
KVØQ	**7**	**90,240**	**283**	**31**	**89**
G3VPW	**"**	**32,518**	**256**	**12**	**59**
NC6M	**"**	**24,800**	**129**	**23**	**57**
UAØSJ	*	5,520	80	8	22
W7DRA	*	2,856	46	11	13
JP2LVT	*	120	10	2	2
SP4GFG	**3.5**	**48,545**	**494**	**17**	**68**
OK1IF	**"**	**23,958**	**323**	**9**	**57**
OM3TKR	**"**	**14,382**	**294**	**6**	**45**
HA8LUH	**"**	**12,261**	**298**	**11**	**56**
RA9CTK	**1.8**	**12,904**	**99**	**10**	**42**
I1BAY	**"**	**8,778**	**239**	**6**	**51**
W8QZA/6	*	30	4	3	3

ASSISTED NORTH AMERICA

UNITED STATES

KI1G	**A**	**5,645,250**	**2668**	**179**	**571**
K5MA/1	**"**	**4,477,640**	**2534**	**156**	**464**
K2RD/1	**"**	**3,837,405**	**1952**	**163**	**552**
W1NG	*	3,429,817	1661	174	577
W1ZT	*	3,150,840	1715	152	508
N1CX	*	3,029,664	1849	140	464
KS1J	*	3,008,532	2238	119	359
K1HI	*	2,887,184	1828	133	459
K1OA	*	2,606,499	1607	123	444

N4XR/1	*	2,368,816	1330	160	496
W1CSM	*	2,304,353	1434	147	452
W1UK	*	2,222,640	1735	122	368
N6RFM/1	*	1,998,244	1207	140	467
N1DG	*	1,846,912	1124	140	474
K1RV	*	1,433,151	1091	123	370
AA1V	*	1,375,584	775	148	496
K1VV	*	1,277,760	979	119	361
K1ST	*	1,232,322	906	119	399
KZ1M	*	1,224,256	1171	102	305
W1RZF	*	1,072,188	842	128	394
K1EO	*	1,000,620	778	123	387
K1AE	*	981,309	687	137	426
N1AO	*	981,094	806	105	349
W1BIH	*	847,704	667	124	370
N8RA/1	*	797,160	635	99	356
W1CU	*	681,876	517	113	355
NZ1Q	*	604,977	608	116	363
N1KWF	*	597,885	633	95	250
K1TS	*	582,891	727	79	252
K1MY	*	548,631	522	107	316
KA1GJ	*	527,072	616	95	267
K1TH	*	483,678	594	82	256
K1JN	*	470,340	505	90	261
W1SRG	*	291,030	448	67	200
			(Op: N1XYR)		
K1JE	*	282,534	361	77	217
N1MD	*	273,726	304	86	247
NC1N	*	261,112	385	69	185
KG1D	*	245,520	310	87	254
W1TO	*	234,900	347	64	197
K8CH/1	*	218,988	261	75	233
KB1SO	*	207,072	363	66	222
K1NU	*	183,885	247	90	209
N1RLI	*	123,464	216	80	173
K1OZ	*	90,216	199	40	128
WY1U	*	65,940	185	46	111
WF1B	*	61,912	160	38	104
K1EU	*	55,942	134	58	108
KT1M	*	50,439	157	39	90
AA1QD	*	34,925	100	39	88
N1NQD	*	10,648	51	38	50
WW1E	*	9,000	48	27	48
K1KU	*	8,568	64	31	53
K2NG	**A**	**6,410,180**	**2773**	**189**	**655**
K2TW	**"**	**5,720,357**	**2755**	**169**	**574**
K2BU	**"**	**4,831,386**	**2246**	**170**	**607**
N2MM	**"**	**4,751,500**	**2518**	**169**	**562**
K2XA	"	4,415,880	2182	166	569
N1EU/2	"	3,921,324	1928	165	567
K2SX	"	3,872,572	2322	154	468
W1GD/2	*	3,198,992	1749	144	502
K2NJ	*	2,807,986	1589	138	496
N2ED	*	2,675,256	1595	146	486
NO2R	*	2,553,687	1318	164	565
K2ONP	*	2,542,772	1464	146	482
AA2DY	*	2,008,681	1576	124	367
KF2O	*	1,976,988	997	168	573
W2GDJ	*	1,600,830	1295	115	347
N2TK	*	1,372,908	709	171	593
WK2G	*	1,314,572	1029	129	403
W2YR	*	1,275,969	796	136	455
N2RM	*	1,162,112	948	103	345
K2XF	*	1,089,414	824	122	400
N2CQ	*	1,008,000	758	120	384
K2RW	*	976,076	757	125	353
K8FC/2	*	937,505	780	121	364
N2FF	*	832,426	659	125	393
W9NGA/2	*	783,636	645	121	370
K2EP	*	766,800	632	103	329
W2RD	*	590,628	486	119	379
K2BX	*	581,880	583	90	300
KQ2O	*	567,324	658	76	230
K2LS	*	446,516	420	125	306
AA2WN	*	408,588	468	118	313
N2VW	*	336,144	379	101	275
W2HCA	*	280,225	384	70	205
N2WK	*	229,710	293	101	209
WK2H	*	197,800	388	54	161
K2PS	*	87,373	207	60	109
K2WB	*	53,342	139	37	112
AA2WQ	*	48,360	127	58	98
NJ2DX	*	4,374	39	23	31
NA2X	**28**	**177,600**	**425**	**34**	**114**
N2KJM	*	97,328	307	28	84
K3WW	**A**	**8,182,098**	**3956**	**176**	**577**
N3RS	**"**	**7,438,200**	**3254**	**178**	**627**
W3EEE	**"**	**4,815,628**	**2527**	**158**	**534**
N3RR	**"**	**4,540,338**	**2206**	**179**	**580**
N3AM	*	3,634,470	2072	147	494
W3FV	*	3,570,040	1739	170	575
K3SV	*	2,599,072	1671	134	440
K3OO	*	2,401,216	1567	145	399
W3OV	*	2,340,648	1638	121	401
K3ND	*	2,222,638	1170	155	527
W3AP	*	2,126,045	1631	145	400
W2UP/3	*	2,054,439	1480	122	409
K3PP	*	1,904,757	1059	153	528
N3NA	*	1,653,875	1194	122	383
W3HVQ	*	1,444,653	1172	127	356
N3ZA	*	1,422,131	974	130	421
K3SA	*	1,352,700	895	133	407
K3NZ	*	1,198,736	807	135	421
NN3Q	*	1,123,441	946	104	347
N3DL	*	1,106,178	702	168	533
K3CP	*	1,016,422	770	123	394
KB3MM	*	1,011,540	814	104	356
WT3P	*	922,982	776	106	348
KE3VN	*	761,425	779	112	363
W3ZL	*	703,692	669	103	293
W3EKT	*	695,913	587	112	309
W3UJ	*	690,800	675	100	300
WA3KPP	*	664,240	718	81	280
W3SB	*	627,646	596	92	306
N3II	*	593,217	573	88	293
W3KV	*	587,898	601	87	255
W3IZ	*	494,145	535	99	296
KU3X	*	334,512	444	63	213
KB3TS	*	321,286	357	91	280
AA3JU	*	312,265	373	89	272
W3UL	*	276,607	409	88	219
K3AR	*	81,395	158	66	157
K3TG	*	64,400	165	54	107
W3OU	*	53,253	134	69	114
NY3C	*	33,153	130	34	95
W3CC	*	30,514	104	48	98
N3GPU	*	12,558	88	23	46
W3TMZ	**21**	**63,945**	**173**	**36**	**109**
K3KO/4	**A**	**2,773,848**	**1628**	**150**	**482**
K4PB	*	690,462	607	116	315
W4NZC	*	255,281	339	79	190
AE4RO	*	94,535	197	58	127
W4WNT	*	70,132	186	66	131
W4JVN	*	23,634	92	37	64
N8PR/4	**3.5**	**53,570**	**208**	**26**	**84**
KR5V	**A**	**2,128,236**	**1811**	**144**	**362**
K5NA	**"**	**1,920,270**	**942**	**180**	**579**
K5PI	*	1,134,240	966	124	356
K5MC	*	853,632	655	139	329
K1DW/5	*	42,864	140	47	94
K5HDU	*	27,216	116	35	73
K6DB	**A**	**2,893,485**	**1821**	**167**	**428**
K6XT	**"**	**1,043,129**	**738**	**153**	**394**
AB6WM	*	387,408	519	110	226
K6SG	*	261,063	340	92	201
NF6R	*	202,464	319	83	145
W6WB	*	189,120	304	85	155
K6RIM	*	89,180	191	53	129
K6XC	*	88,796	221	58	100
KI6Y	28	44,574	199	28	74
N6ND	**21**	**371,348**	**828**	**39**	**133**
N7CW/6	*	272,896	632	38	126
NX7K	**A**	**1,970,927**	**1616**	**142**	**369**
N7NG	**"**	**1,603,974**	**1006**	**161**	**430**
N7RO	*	1,309,306	1238	113	284
K6KR/7	*	926,788	787	123	323
KK7A	*	85,461	200	68	115
N7IX	*	56,027	172	62	117
W7MCU	*	36,984	102	52	82
N7UJJ	*	30,510	108	35	78
NØAH/7	**3.5**	**48,804**	**304**	**26**	**58**
N8BJQ	**A**	**2,592,758**	**1622**	**145**	**429**
ND5S/8	*	1,463,392	854	160	498
AA8U	**21**	**628,975**	**1278**	**39**	**142**
W8QID	**7**	**214,320**	**564**	**34**	**107**
N9CK	**A**	**3,048,969**	**1837**	**151**	**440**
WE9V	**"**	**1,751,314**	**1090**	**140**	**461**
KC9TV	*	430,752	499	91	245
K9OSH	*	245,440	376	90	205
N9AU	**7**	**221,112**	**570**	**35**	**113**
NØDY	**A**	**2,372,475**	**1680**	**135**	**390**
NRØX	**"**	**2,169,088**	**1383**	**142**	**450**
N5IN/Ø	*	1,165,000	1000	132	368
KØOB	*	718,751	740	104	257
NØAT	*	512,460	474	113	277
AKØM	*	483,658	521	97	261
WRØDK	*	85,100	187	66	119
WB8ZRL/Ø	*	57,833	140	38	113
KØXD	*	50,175	273	80	143
KØIL	*	39,468	114	42	90
KZØC	*	28,704	155	73	135
KKØDX	*	9,360	51	34	46
WØTM	**28**	**551,918**	**1228**	**37**	**126**
WØCP	*	409,020	926	37	133
WØWP	*	345,984	992	34	125

CANADA

VA3DX	**A**	**1,626,570**	**1149**	**154**	**429**
VE3RZ	*	592,200	693	85	265
VE4COZ	*	209,055	357	71	160
VE6TN	*	96,005	243	68	143

PUERTO RICO

NP4A	**28**	**1,206,492**	**3058**	**37**	**122**
			(Op: DL2CC)		
WP3R	**21**	**1,098,944**	**2834**	**37**	**117**
			(Op: DL5XL)		

ASIA

ASIATIC RUSSIA

RA9AC	**21**	**473,097**	**1115**	**40**	**139**
RA9AA	**14**	**612,675**	**1381**	**40**	**135**
RAØAM	**A**	**68,115**	**201**	**91**	**194**

CHINA

BA4DW	**A**	**109,725**	**344**	**47**	**85**

JAPAN

JA1YNE	**A**	**3,055,112**	**2260**	**154**	**354**
JA9XBW	**"**	**1,377,664**	**1197**	**141**	**317**
7L4IOU	*	451,782	559	132	210
JA1JQY	*	432,678	601	93	187
JK2VOC	**"**	**400,520**	**550**	**115**	**195**
JI1CQA	*	184,203	342	78	133
JHØSGG	*	4,876	40	17	29
JR8OGB	**28**	**209,605**	**819**	**34**	**69**
JHØALB	*	38,416	145	33	65
JR9NVB	**21**	**201,376**	**571**	**36**	**88**
JQ1NGT	**"**	**127,260**	**516**	**31**	**59**
JAØBMS/1	*	91,872	336	32	64
JK3DGX/3	*	43,800	166	32	68
JE1CKA	**7**	**376,855**	**1014**	**34**	**111**
JH1BBT	**3.5**	**18,216**	**101**	**27**	**45**

JORDAN

JY9QJ	**A**	**3,022,326**	**1973**	**135**	**447**

KAZAKHSTAN

UPØF	**A**	**1,523,632**	**1405**	**118**	**366**
			(Op: UN7FK)		
UN7FZ	**28**	**465,264**	**1240**	**33**	**129**

KOREA

HL1/JI1EFP	**A**	**119,214**	**562**	**48**	**63**

EUROPE

AUSTRIA

OE5OHO	**A**	**2,457,600**	**2149**	**127**	**385**
OE2S	*	1,231,920	1218	134	388
OE3ZK	**14**	**105,506**	**522**	**35**	**107**

BELGIUM

OT9T	**A**	**8,511,750**	**4386**	**193**	**680**
			(Op: ON4UN)		
OT9L	**14**	**574,035**	**1771**	**39**	**126**
			(Op: ON4AKL)		

BOSNIA-HERZEGOVINA

T94MZ	**21**	**348,920**	**1666**	**29**	**93**

CROATIA

9A3ZG	A	5,070	63	21	44
9A4KK	**28**	**282,744**	**787**	**39**	**115**
9A4KA	7	1,025	16	10	15
9A2U	**3.5**	**66,375**	**718**	**14**	**61**
9A9AU	*	154	8	4	7

CZECH REPUBLIC

OK2FD	**A**	**3,263,351**	**2002**	**168**	**595**
OK1FDY	**"**	**1,875,776**	**1926**	**121**	**432**
OK1DG	*	1,300,364	1415	111	331
OK1WWJ	*	29,520	132	41	79
OK2ZI	**28**	**139,920**	**453**	**38**	**94**

DENMARK

OZ1FAO	**A**	**383,688**	**557**	**68**	**224**

ENGLAND

G3TMA	**A**	**241,082**	**471**	**83**	**215**
G4PDQ	**28**	**138,592**	**494**	**31**	**91**

EUROPEAN RUSSIA

UA4HTT	**A**	**2,624,720**	**2466**	**140**	**462**
UA1QV	**"**	**1,822,450**	**1859**	**127**	**447**
RK3BY	*	663,950	1095	88	262
UA3AP	*	650,149	877	100	259
UA6AN	*	3,256	42	14	23
UA3PW	**1.8**	**18,585**	**270**	**9**	**50**

FINLAND

OH5NQ	**A**	**4,178,694**	**3168**	**147**	**487**
			(Op: OH6EI)		
OH6NIO	*	2,578,278	1808	141	472
OH6YF	*	1,631,656	1647	144	397
OH4JFN	*	718,956	1248	91	233
OH2LU	*	536,760	801	81	274
OH1MA	**28**	**301,920**	**871**	**39**	**131**
OH6AC	**21**	**729,289**	**1931**	**39**	**128**
			(Op: OH6CS)		
OH2BCI	**1.8**	**41,475**	**504**	**14**	**61**
OH2BO	*	14,454	140	18	55

FRANCE

F5RBG	**A**	**167,940**	**447**	**50**	**130**
F6KPQ	**28**	**498,150**	**1393**	**37**	**125**
			(Op: F5PHW)		
F5AKL	7	17,641	140	13	46

GERMANY

DF3CB	**A**	**4,343,312**	**2392**	**181**	**588**
DJ2YA	**"**	**2,979,200**	**1592**	**174**	**610**
DK5QN	**"**	**2,955,615**	**2237**	**163**	**496**
DF4RD	*	2,000,704	1259	163	564
DL5DXF	*	1,158,495	1097	124	383
DL3NEO	*	1,146,640	1348	103	337
DJ5BV	*	1,106,350	1028	126	419
DF4PD	*	958,288	1060	138	455
DL1NEO	*	954,222	1054	91	352
DL7ALM	*	742,400	857	112	352
DL5CF	*	703,486	952	118	343
DL8KJ	*	426,600	608	97	298
DF2UU	*	416,615	434	133	352
DL6KVA	*	217,638	346	86	128
DL9NDV	*	190,548	349	80	188
DK9DA	*	175,177	263	85	198
DK5WL	*	158,191	370	59	138
DL5AUA	*	138,528	338	49	95
DL5ZB	*	76,032	164	74	142
DL8AAM	*	25,938	131	35	64
DL4NAC	**28**	**629,610**	**1355**	**40**	**146**
DL8UD	*	426,048	1203	39	129
DK3GI	**21**	**705,060**	**1776**	**40**	**140**
DK3DM	*	541,112	1408	39	133
DK8FS	**7**	**92,720**	**426**	**28**	**94**

HUNGARY

HAØHW	**A**	**531,828**	**717**	**99**	**275**

IRELAND

EI6FR	**28**	**370,678**	**1269**	**36**	**118**

ITALY

IQ2A	**A**	**2,322,704**	**3078**	**100**	**258**
IKØHBN	*	1,007,160	889	136	409
IK4WMH	*	638,064	855	95	283
I3MDU	*	3,564	30	18	26

LITHUANIA

LY8X	**A**	**4,431,636**	**3030**	**156**	**526**
			(Op: LY2BIL)		

NETHERLANDS

PA3FNE	**A**	**74,480**	**282**	**55**	**135**

POLAND

SP2JKC	**A**	**2,421,323**	**1773**	**146**	**461**
SP9W	*	1,686,000	2120	128	372
			(Op: SP9HWN)		
SP1MHV	*	8,856	49	33	49
SQ9HYM	**28**	**141,398**	**470**	**33**	**122**

SCOTLAND

GMØF	**A**	**1,818,180**	**1958**	**126**	**429**
			(Op: GM4AFF)		

SLOVAK REPUBLIC

OM5A	**A**	**1,056,383**	**1134**	**119**	**380**
			(Op: OM3LA)		
OM3IAG	*	994,560	1386	104	316

SLOVENIA

S56A	**A**	**1,731,450**	**1471**	**131**	**464**
S59L	**3.5**	**63,296**	**577**	**17**	**75**

SPAIN

EA5WU	**A**	**1,804,950**	**1791**	**124**	**401**
EA3ALV	*	175,854	305	90	228
EA7AGW	*	33,110	232	16	70
EC5JJ	21	19,136	294	13	39

SWEDEN

8S5A	**A**	**2,187,180**	**2143**	**126**	**396**
			(Op: SM5AJV)		
SK6D	*	402,900	948	72	183
SM6A	*	297,850	623	91	231
			(Op: SM6DYK)		
SM5FUG	*	269,040	587	65	175

SWITZERLAND

HB9AFH	A	38,040	117	44	76

UKRAINE

UTØU	**A**	**4,370,327**	**3277**	**162**	**527**
			(Op: UT5UDX)		
UT5UGR	**"**	**2,718,247**	**2976**	**149**	**524**
UT5UFT	*	14,688	103	32	64

YUGOSLAVIA

YU7NU	**A**	**3,242,525**	**2342**	**165**	**550**
YU7AL	**28**	**389,520**	**1000**	**38**	**142**
YU1AAX	**14**	**91,670**	**536**	**30**	**73**
			(Op: Buco)		
4N7RGH	3.5	14,553	224	10	53
YU1RA	**1.8**	**28,016**	**419**	**7**	**61**

OCEANIA

BRUNEI

V8A	**A**	**6,889,770**	**4328**	**153**	**402**
			(Op: JO1RUR)		

SOUTH AMERICA

ARGENTINA

LU5FA	**A**	**796,086**	**1874**	**84**	**198**
LU7EAR	*	127,161	271	72	127

BRAZIL

PY2NFE	A	14,823	107	30	51

MULTI-OPERATOR SINGLE TRANSMITTER

NORTH AMERICA

UNITED STATES

K1KI	**11,590,494**	**4750**	**199**	**680**
K1IR	**7,481,942**	**3903**	**166**	**588**
W1HR	3,273,316	1966	143	486
K1GW	3,231,180	1985	142	477
AA1ON	3,230,262	1860	151	500
N1AU	1,631,840	1265	118	352
N1TB	488,600	704	76	204
W1NR	467,742	411	110	308
N2NU	**11,213,664**	**4565**	**199**	**703**
W2AA	**6,586,408**	**3155**	**181**	**616**
AA2FB	5,769,842	3069	160	549
W6XR/2	4,670,523	2442	173	568
N2LBR	1,664,480	1164	119	386
K2SB	1,199,542	850	140	446
N2SS	1,030,722	739	114	392
WA2UBK	295,484	390	93	253
K3PH	**4,181,148**	**2263**	**150**	**516**
NE3F	**2,323,662**	**1691**	**146**	**481**
W3LJ	510,864	636	93	255
WY3T	77,677	202	50	123
WX3B	74,500	189	43	106
N4AF	**6,323,840**	**3547**	**162**	**494**
K4OJ	**5,819,475**	**2967**	**179**	**596**
N4RV	3,482,645	1916	170	525
W4PRO	526,750	485	129	301
AD4ES	133,644	316	73	149
WXØØ/5	**6,031,114**	**2996**	**193**	**625**
N5KB	586,044	638	115	323
KG6OK	**2,840,458**	**1978**	**162**	**437**
K6ZM	**2,702,470**	**2097**	**154**	**376**
W6YX	1,809,428	1427	136	346
W7VJ	**3,398,340**	**2384**	**152**	**390**
AD7U	1,388,170	1105	149	341
K8AZ	**9,636,380**	**4185**	**193**	**652**
K8LX	**6,880,962**	**3338**	**179**	**582**
W8ZA	2,543,274	1383	163	524
K9LA	**3,881,432**	**2142**	**183**	**560**
K9BF	**1,942,380**	**1448**	**132**	**408**
WN9O	1,741,645	1053	160	495
WB9ZEZ	101,853	237	58	134
NØAV	**5,041,344**	**2536**	**173**	**553**
KJØG	817,380	976	106	274

BAHAMAS

C6AJX	**5,132,085**	**4180**	**144**	**411**

BARBADOS

8P9Z	**18,711,252**	**8245**	**192**	**669**

CANADA

VE3EJ	**12,803,210**	**5573**	**201**	**700**
VE6SV	**4,845,288**	**3632**	**158**	**446**
VO2WL	**3,206,385**	**3489**	**107**	**298**
VE6AO	719,320	1235	104	176

CAYMAN ISLANDS

ZF2AM	**6,186,411**	**5155**	**138**	**415**

COSTA RICA

TI5N	**6,796,627**	**5418**	**164**	**509**

JAMAICA

6Y3A	**5,826,730**	**5532**	**135**	**359**

MEXICO

6D2X	**11,017,378**	**6505**	**185**	**572**

TURKS & CAICOS ISLANDS

VP5DX	**4,439,730**	**4116**	**149**	**421**

AFRICA

SAO TOME & PRINCIPE

S92CW	**1,607,813**	**2470**	**65**	**204**

ASIA

ASIATIC RUSSIA

UA7A	**10,465,890**	**4977**	**187**	**648**
RF9C	**8,067,312**	**3964**	**173**	**619**
RK9KWI	3,597,606	3151	138	400
RA9ST	2,066,460	1851	101	303
RK9SWF	1,366,077	1697	99	298
RK9TWA	77,131	233	39	98

AZERBAIJAN

4K7Z	**2,145,564**	**2097**	**99**	**329**

CHINA

B4R	**2,197,656**	**3063**	**122**	**271**
BY1PK	1,309,182	2501	85	209

CYPRUS

P3A	**19,243,476**	**8288**	**191**	**691**

JAPAN

JH7PKU	**6,321,490**	**3431**	**181**	**498**
JA7YAA	**5,690,073**	**3106**	**182**	**501**
JR1ZTT	**5,304,783**	**3133**	**181**	**498**
JE4VVM	**4,856,400**	**3128**	**170**	**430**
JK6SEW	**3,747,960**	**2703**	**165**	**415**
JA1YPA	3,562,286	2742	157	372
JA1ZLO	3,008,400	2186	164	388
JI2KVW	**1,646,110**	**1692**	**131**	**290**
JA6ZLI	1,579,305	1403	141	304
JA2ZJW	1,544,265	1581	124	245
JF2SKV	1,044,530	1285	114	221
JE2YHS	762,650	986	122	228
JA9YBA	1,037	34	9	8

LEBANON

OD5/OK1MU	**8,396,514**	**5006**	**150**	**529**

THAILAND

HSØAC	**1,867,212**	**2206**	**141**	**345**

UK BASES ON CYPRUS

ZC4AKR	**12,639,016**	**6767**	**145**	**544**

EUROPE

4U-VIENNA

4U1VIC	**5,237,456**	**4315**	**162**	**545**

ALAND ISLANDS

OHØR	**8,912,539**	**5362**	**169**	**610**

ALBANIA

ZA/S51F	**7,050,393**	**5478**	**148**	**533**

AUSTRIA

OE1W	**21,049**	**98**	**39**	**58**

BALEARIC ISLANDS

EA6IB	**11,670,260**	**6712**	**186**	**682**

BELGIUM

OT9P	**2,186,520**	**2415**	**127**	**405**
OT9K	1,153,240	2091	111	329

BULGARIA

LZ1ABC	**1,203,039**	**1467**	**106**	**353**

CROATIA

9A7A	**7,594,566**	**4662**	**174**	**624**
9A7P	1,760,889	2110	109	380
9A1CMS	1,299,641	1660	95	306
9A1CIG	40,872	283	20	84

CZECH REPUBLIC

OK5W	**7,946,523**	**4293**	**193**	**704**
OL3A	**6,857,484**	**4285**	**183**	**644**
OL5Q	**4,275,722**	**3431**	**138**	**445**
OK1RR	4,213,008	2822	173	643
OK2KOD	1,307,124	1319	120	374
OK2KDS	1,138,040	1237	102	358
OK1KAO	351,528	787	74	228
OK1KCF	108,997	329	46	115
OL5DX	100,762	333	46	120

DENMARK

OZ/DJ9RR	**3,275,965**	**3256**	**139**	**496**
OZ5WQ	**2,732,960**	**2905**	**149**	**471**

ESTONIA

ES5Q	**6,917,295**	**4558**	**177**	**618**

EUROPEAN RUSSIA

RU1A	**11,360,022**	**5251**	**202**	**737**
RW4LYL	**5,147,874**	**4132**	**174**	**600**
RZ1AWO	1,406,684	1815	100	346
RK6AYN	1,260,504	1712	114	390
RK3QWM	865,788	1168	109	353
RK4FWX	795,644	1762	88	273
RW3WWW	781,862	1458	89	271
RK3UWA	760,864	1101	99	317

FINLAND

OH7M	**9,140,535**	**4513**	**193**	**694**
OH1F	**8,957,646**	**4554**	**196**	**725**
OH6K	2,417,097	2151	152	517

FRANCE

TM2Y	**10,893,247**	**5578**	**193**	**694**
F5SSG	1,926,332	2611	112	327
F8KHZ	753,375	1079	88	287
F6KRK	433,836	955	83	241

GERMANY

DK6WL	**8,593,500**	**4512**	**180**	**670**
DL1QW	**3,394,593**	**2423**	**160**	**553**
DF1LX	**2,693,194**	**2106**	**151**	**507**
DJ5CL	2,690,980	2135	144	484
DFØAT	2,483,264	2087	144	500
DK1II	2,226,276	1854	146	493
DFØCI	1,576,638	1544	147	455
DKØTZ	1,098,000	1269	112	338
DKØRE	504,340	1028	91	243
DKØFFO	371,952	710	77	259

ITALY

IR4T	**9,772,505**	**5077**	**195**	**700**
IQ4A	**9,506,760**	**4768**	**192**	**716**
IO2A	**6,354,810**	**3960**	**174**	**612**
II2K	4,105,045	2940	148	517
II1R	3,525,180	2954	145	470
IO2L	276,900	716	58	137
IR1S	1,440	45	13	23

LATVIA

YL4U	**7,327,140**	**4679**	**193**	**677**

LIECHTENSTEIN

HBØ/HB9LF	**5,693,028**	**4646**	**135**	**514**

LITHUANIA

LY3AV	**2,513,215**	**2604**	**152**	**509**
LY2OM	704,770	1033	97	333

LUXEMBOURG

LX/DL4SDX	**3,089,268**	**3511**	**127**	**406**
LX9DIG	**2,307,893**	**3439**	**108**	**379**

MACEDONIA

Z3ØM	**4,263,942**	**3648**	**146**	**532**

MONACO

3A/WØYR	**4,629,456**	**4707**	**139**	**485**

NETHERLANDS

PI4CC	**4,241,538**	**3513**	**151**	**535**
PI4DEC	2,219,580	2051	121	410

NORWAY

LA8W	**7,458,836**	**4597**	**177**	**617**
LA9GX	**6,272,162**	**4299**	**171**	**590**
LA1K	858,750	1480	88	287

POLAND

SP3KFH	**2,270,846**	**1943**	**133**	**421**
SP1PEA	**2,178,280**	**1921**	**141**	**427**
SP9KRT	999,750	1145	102	328
SP1PLA	24,840	86	47	68

ROMANIA

YO8KOS	**1,049,092**	**1326**	**120**	**332**
YO5KAD	75,660	296	44	11

SCOTLAND

GM6NX	**4,496,224**	**3993**	**144**	**452**

SLOVAK REPUBLIC

OM8A	**9,799,288**	**5300**	**191**	**683**
OM7M	**7,758,036**	**4514**	**177**	**645**
OM5M	**7,673,988**	**4181**	**186**	**682**
OM3A	**7,065,162**	**4080**	**180**	**651**
OM3KZA	44,478	128	51	75

SLOVENIA

S52OP	**3,242,941**	**2961**	**143**	**476**

SPAIN

EA5BY	**4,371,066**	**4029**	**141**	**473**
EA5CW	1,148,674	2048	88	294

SWEDEN

SK3W	**8,604,576**	**4524**	**190**	**676**

SWITZERLAND

HB7OGR	**433,521**	**1092**	**74**	**245**

UKRAINE

UT7Z	**5,327,079**	**4060**	**162**	**537**
UT7L	**1,980,027**	**1867**	**138**	**455**
EM4E	1,624,656	2088	120	408
UR4MWU	468,452	848	74	258
UR4LWY	162,048	294	80	176
EN5J	43,964	216	38	78
UU5J	3,104	47	13	19

YUGOSLAVIA

YZ7A	**1,499,950**	**1933**	**107**	**351**
YT1Z	**1,041,600**	**1558**	**95**	**325**
YU1AOI	192,160	1012	35	125
YU1INO	172,250	811	65	185

OCEANIA

EASTERN KIRIBATI

T32PO	**3,252,678**	**3084**	**128**	**246**

EAST MALAYSIA

9M6AAC	**6,443,980**	**4488**	**162**	**428**

GUAM

AH2R	**9,244,890**	**4728**	**180**	**515**

HAWAII

NH7A	**6,940,420**	**4682**	**167**	**381**

INDONESIA

YB3ZES	96,832	287	49	87

NEW ZEALAND

ZM2K	**6,329,375**	**4217**	**145**	**388**

SOUTH AMERICA

ARGENTINA

LU8XW	**357,304**	**1208**	**28**	**90**

BRAZIL

PY3MHZ	2,340	57	9	9

CHILE

CE3F	**7,367,487**	**4547**	**164**	**469**

URUGUAY

CX5O	124,936	545	61	123

SOUTH SHETLAND

R1ANF/A	**1,072,000**	**1701**	**87**	**163**

MULTI-OPERATOR MULTI-TRANSMITTER

NORTH AMERICA

UNITED STATES

KC1XX	**24,602,524**	**9580**	**213**	**770**
W3LPL	**23,539,901**	**9101**	**211**	**772**
K3LR	**23,379,714**	**8997**	**211**	**752**
K9NS	**16,032,942**	**6902**	**210**	**699**
K1TTT	**14,223,600**	**6626**	**195**	**683**
K2LE/1	**13,651,588**	**6198**	**185**	**636**
K1RX	12,979,325	5994	193	672
W3PP	12,968,464	6023	185	663
W4MYA	**11,779,772**	**5172**	**193**	**681**
K4VX/Ø	**11,680,785**	**5865**	**182**	**583**
K8CC	**11,214,120**	**5539**	**191**	**636**
W8AV	10,272,170	4899	191	644
KØRF	10,213,872	5068	197	619
W3EA	8,962,008	4510	181	637
WØAIH/9	8,812,804	4301	184	597
W7RM	**8,568,775**	**5000**	**192**	**533**
N6AW	**7,888,810**	**4208**	**186**	**524**
KB1H	7,861,690	3820	177	601
NR4M	6,941,493	4113	171	540
K3II	5,594,875	2962	162	553
N3AD	5,386,536	3171	166	545
W3MM	4,938,165	2277	181	620
W2CG	4,273,997	2339	156	545
N2BIM	3,487,950	1999	157	533
N1RR	3,189,760	2010	143	497
W6OAT	2,757,989	1706	162	439
W1QK	2,565,792	1693	136	468
WU3M	991,827	715	142	429
NM3K	785,519	946	96	295

ALASKA

KL7Y	**25,276,806**	**13490**	**193**	**590**

ANTIGUA

V26K	**13,232,820**	**8135**	**151**	**494**

CANADA

VE5FN	**1,739,025**	**2366**	**112**	**235**
VE5RI	**1,633,020**	**2348**	**110**	**230**
VE2CQ	90,202	340	44	75

GRENADA

J3A	**19,555,200**	**11028**	**181**	**595**

AFRICA

CHAGOS ISLANDS

VQ9IO	**5,027,589**	**3548**	**150**	**417**

CEUTA & MELILLA

EA9EA	**30,316,678**	**13450**	**181**	**645**

GHANA

9G5AA	**34,918,107**	**13798**	**195**	**708**

MOROCCO

CN8WW	**70,713,270**	**23068**	**219**	**843**

ASIA

JAPAN

JA5BJC	**15,256,054**	**7362**	**201**	**580**
JA3ZOH	**13,923,768**	**6908**	**197**	**579**
JA3YKC	2,170,896	2617	96	240

MONGOLIA

JT1JA	**6,224,829**	**6406**	**152**	**427**

UNITED ARAB EMIRATES

A61AJ	**38,789,751**	**15812**	**213**	**788**

EUROPE

4U-GENEVA

4U1ITU	309,524	820	57	166

BELARUS

EU5F	**3,311,905**	**3368**	**127**	**466**

CZECH REPUBLIC

OL7W	**6,147,740**	**4249**	**158**	**587**

DENMARK

OZ5W	**7,127,278**	**5083**	**160**	**538**

DODECANESE

J45T	**8,265,895**	**9306**	**153**	**532**

ENGLAND

M4T	209,440	619	53	167

EUROPEAN RUSSIA

RS3A	**11,568,934**	**7499**	**192**	**706**

FINLAND

OH2U	**22,244,067**	**10956**	**211**	**786**

GERMANY

DFØHQ	**20,013,588**	**10671**	**209**	**757**
DLØKF	6,262,656	4776	162	590

HUNGARY

HG6N	**15,457,260**	**9603**	**190**	**704**

KALININGRAD

RW2F	**21,568,933**	**11101**	**218**	**789**

LITHUANIA

LY7A	**10,484,880**	**7016**	**182**	**658**

NETHERLANDS

PI4COM	**12,721,272**	**7976**	**186**	**690**

SCOTLAND

GM7V	**16,595,772**	**10054**	**197**	**729**

SPAIN

EA4ML	**11,286,669**	**8030**	**169**	**602**
EA4RCV	110,715	551	50	133

SWEDEN

SM5HJZ	153,846	283	81	144
8S5X	141,255	281	80	139

UKRAINE

UU7J	**3,023,924**	**3000**	**185**	**587**
UX8IXX	140,504	1155	88	298

SOUTH AMERICA

NETHERLANDS ANTILLES

PJ4B	**47,516,600**	**17889**	**208**	**757**

PARAGUAY

ZP6T	**7,958,104**	**4983**	**165**	**451**

VENEZUELA

4M7X	**40,142,880**	**15763**	**203**	**712**

Disqualified: HG1S (HA1TJ) single op with multiple signals & multiple time modifications.

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IDBT: A Breakthrough in Selectivity!

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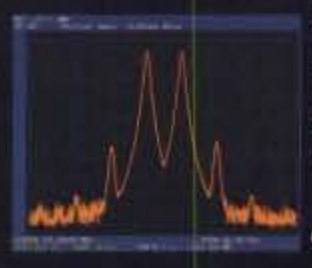

Class A 75 W PEP IMD

IV. Class-A SSB Operation

Exclusively available on the MARK-V FT-1000MP , a press of a front-panel button engages Class-A SSB operation of the transmitter, at a power output level of 75 Watts. Class-A operation produces incredibly clean signal quality, with 3rd- order IMD suppressed 50 dB or more, and 5th- and higher-order products typically down 80 dB or more!

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Photo shows optional MD-100A8X Deluxe Desk Microphone

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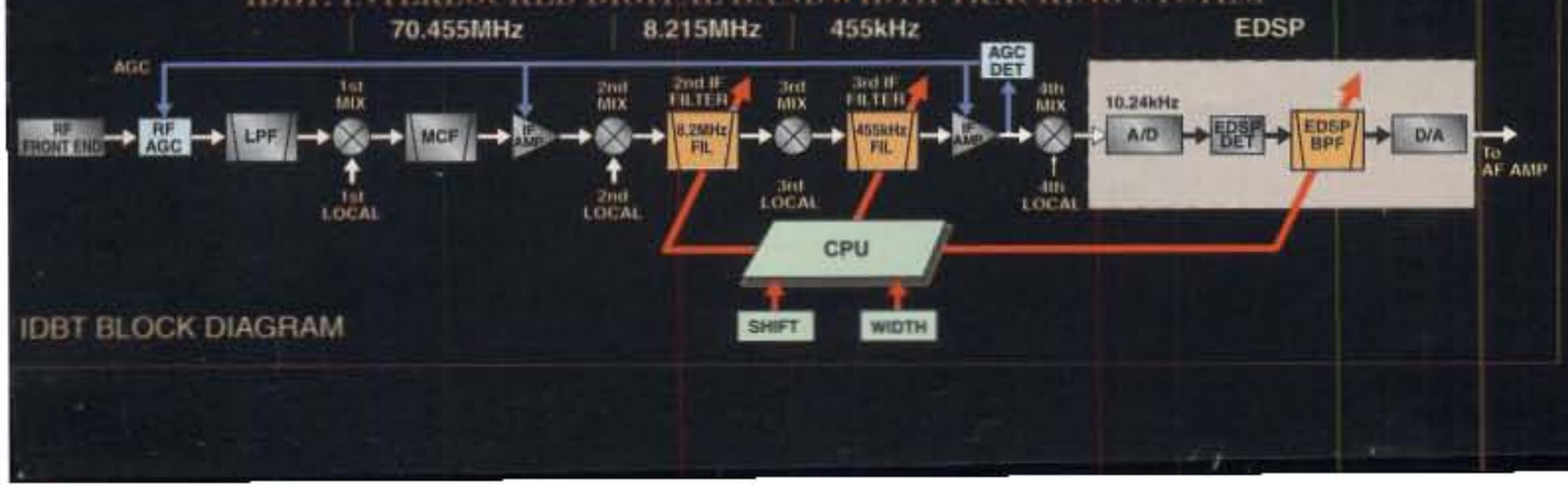

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A scene from the Bhutan DX'pedition

KINGDOM OF BHUTAN A52A OVER 82,000 QSO'S

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- A52A member Glenn Johnson, WØGJ

One of Clipperton Islands' main inhabitants

One of the DX stations set up on Clipperton

ICOM banner from the Bhutan DX'pedition

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