By Jim McMasters, KD5BUR

High-Speed CW and Meteor Scatter—An Exciting VHF DX Medium!

European hams have been bouncing ultra-high-speed CW signals off the fiery trails of meteors for years. Now American hams are discovering the excitement. You don't need a super VHF station, you don't have to be a CW whiz and you don't even need to wait for a meteor shower!

Does your 2-meter all-mode radio stay tuned to 144.200 MHz most of the time, generating the all-too-familiar white noise of an idle band? Do you occasionally call CQ only to be rewarded by the same white-noise response? Tropo openings aren't everyday occurrences on 2 meters, and E-skip conditions are all but nonexistent.

How would you like to put your all-mode radio to work making DX contacts whenever you want? All you need is a good dose of persistence and an introduction to high-speed CW (HSCW) via meteor scatter (MS). Since I began using this mode in November 1997, it has put excitement back into my weak-signal VHF operations. My HSCW station is modest: a Yaesu FT-290 mobile/portable all-mode transceiver driving a 100 W brick amp into a Cushcraft 17B2 Yagi antenna. If you are a VHF DX hound/grid hunter, then this may be just the thing to fuel your fire.

HSCW is Not New!

HSCW has been in use in Europe for a couple of decades. European VHFers often work three or four different stations per hour, without the benefit of a meteor shower, using this mode. During major meteor showers, several DXpeditions may be conducted by teams of operators to activate rare grid squares throughout Europe and western Asia. Grid hunting with HSCW is very popular there. One operator notes that he has worked "...hundreds of new grids (now at #651...) over the years."[1] HSCW activity has been described several times in the pages of *QST*.[2]

[1]Notes appear on page 39.

This sounded like something I really wanted to try. But, I wondered, how could it be possible to work new grids on 144 MHz at almost any hour, almost every day? In order to understand, I first had to learn a little bit about how QSOs are made using meteor scatter. Let's begin our quest for "anytime VHF DX" with a brief review of meteors themselves.

Space Invaders

Meteors are small particles of matter, most only the size of a grain of sand. Some are the leftovers from the formation of our Solar System; others are thrown off by celestial bodies such as comets. When the Earth passes through a high concentration of cosmic debris, we have a meteor shower.

The secret of HSCW meteor-scatter success is the fact that debris is falling into our atmosphere *constantly*. The Earth sweeps up hundreds of tons of space matter each year. On any given day, over *12 billion* meteors impact the atmosphere! The vast majority of these meteors are what are called "sporadic," or random, meteors because they aren't numerous enough to be noted as a shower. The large number of these random meteors makes it possible for you to work new VHF DX almost whenever you want.

Meteors enter the atmosphere and begin burning at heights ranging from 110 to 100 km (66 to 60 miles), depending on how fast they enter. This is about the same height as the E layer of the ionosphere, the region of our atmosphere that gives us our familiar E-skip openings! Thus, the distance over which we can work is about the same for both meteor scatter and E skip. The faster the meteors enter, the more quickly they incinerate (and at higher altitudes).

As meteors burn up in the atmosphere, they form either *underdense* or *overdense* trails. Overdense trails typically create ionization so intense that, to radio waves, the trail looks like a cylindrical metallic reflector. These trails strongly reflect radio signals, sometimes for as long as a minute or more, even long enough to complete several contacts using SSB. Unfortunately, overdense trails and the "bursts" they produce are uncommon except near the peaks of meteor showers.

Underdense meteor trails, on the other hand, provide only very short reflections (commonly called *pings*). The ionized trail tends to scatter radio signals rather than reflecting them. While underdense trails only last a fraction of a second and seldom reflect more than a syllable or two of voice, they are extremely common. As you're reading this sentence, multitudes of underdense trails are flashing into existence miles above your head, then disappearing.

Fast-burning underdense meteor trails were discovered by the first ham operators to make 2-meter contacts via meteor scatter. They used high CW keying speeds in their tests. The keying speeds were well beyond what any human could possibly decipher, so they recorded the signals on audiotape and reduced the speed by 50% or more for decoding. They soon learned that these short-lived meteor trails could be used to relay quick bursts of information.

HSCW—How Fast is "Fast"?

Having been absent from ham radio for more than 20 years, I was curious how "weak signal" VHF work had changed. I first found

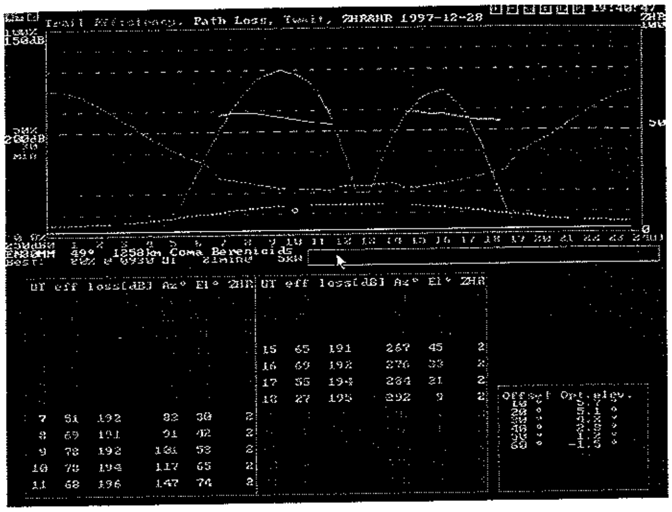


Figure 1—The *MSSOFT* "geometry" screen displays data such as meteor trail efficiency, path loss, azimuth and elevation of the shower, beam heading and distance to station. The date can be changed easily from this screen to watch the changes occur in the shower geometry. The distant station's "locator" or grid can also be changed to recalculate a new set of values.

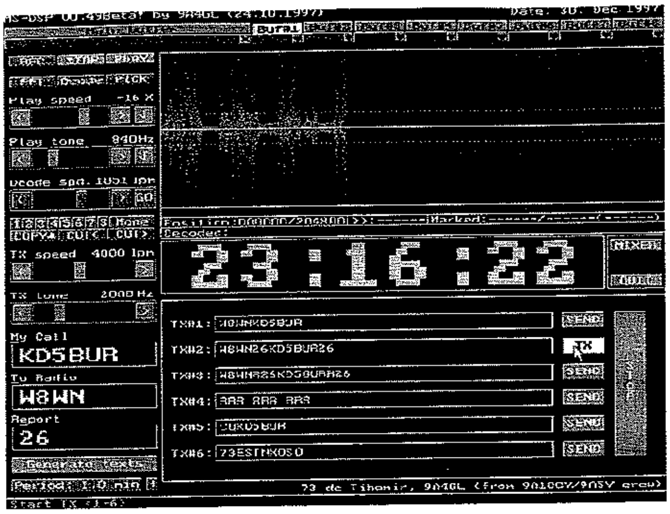


Figure 2—*MS DSP*, written by Tihomir Heidelberg, 9A4GL, is popular among HSCW operators. Above the digital clock is the main receive buffer. When a burst is heard, the operator marks the buffer spot and saves the burst to one of eight buffers above. During the next transmit period the saved buffer areas are replayed while varying the speed and tone with controls to the left. Transmit data is changed (lower left) and selected as necessary (lower right).

references to HSCW while browsing the Internet. Time after time, I encountered Web sites mentioning this "new" mode of communication using meteor scatter, with some site authors making astonishing claims of working new grids on 144 MHz almost every day! This mode of communication was more successful than anything I had ever heard of. One operator commented, "...you don't need major showers for an MS QSO! If I make a sked for tonight or tomorrow morning in the 650-1000 mile range, we are 95% sure to complete the contact."[3] The more I read, the more eager I became to try this "new" mode.

Just how fast is HSCW? Here are some typical examples for comparison:

Conversational CW	15 WPM
Contest-style CW	30 WPM
SSB	200 WPM
Slow HSCW	200 WPM
Fast HSCW	800 WPM
Very fast HSCW	1200 WPM
Ultra fast HSCW	1600 WPM

You can see that even slow HSCW is just as fast as most SSB operators care to speak, except, possibly, those whose occupation is auctioneering!

Hardware and Software

Traditional hardware for HSCW calls for modified tape recorders for recording and slowing down received signals, and memory keyers (with audio oscillators for tone-injection keying) for transmitting high-speed CW. There are hardware interface circuits readily available to utilize such equipment.[4] With my background in computers, I was immediately interested in the newly available software offered as shareware. I had just purchased a new state-of-the-art computer complete with a true SoundBlaster sound card, which I had little doubt would work for this application, and so I decided to try the computer method. (As you'll see later on, however, you don't need a powerful PC like mine to work HSCW.)

As I surfed the Web it became apparent that there were several ways to transmit and receive HSCW using ordinary home computers. At first I had a concern about whether my rig could handle such fast keying speeds; but then I found that most hams were keying their rigs by injecting a keyed 2000 Hz tone directly into the mike jack while operating in the USB (upper sideband) mode. This is mode *J2A* and is virtually equivalent to pure CW.

There are programs that will handle the transmitter keying only and do not need a sound card, although an audio oscillator and a simple interface are required. One such program is *MSSOFT* by Ilkka Yrjola, OH5IY.[5] This shareware program also features an MS scheduler, whereby upcoming schedules may be entered and even integrated into an automatic transmit sequence. Another highlight of this program is the fantastic MS path efficiency analysis section (see Figure 1). The documentation that comes with *MSSOFT* is a good education on both the program itself and meteor scatter work in general.

Another program, written by Al Van Buren, K7CA, sends a keyed tone to the computer's speaker, which can be tapped off and fed into the mike jack.[6] Still another way to go is to use a memory keyer, such as the CMOS Super Keyer, which is capable of up to 4950 LPM (*QST*, August 1995), coupled with a suitable audio oscillator.[4] The keyer will take care of the transmit side and a modified cassette tape recorder can handle the receive recording duty. European experience dictates that the modified cassette tape recorder method will work up to a speed of approximately 1500 LPM. There is a German digital tape recorder now available that a number of Europeans are using.[8] As none are in use over here, it is not known how well this device will work for North American style HSCW operation. I should also mention that there is a group of dedicated US operators who are studying the possibility of developing affordable non-computer hardware to operate HSCW.

When it comes to computer programs, which handle both transmit and receive simultaneously on one machine, there are few choices at the present time. However, this method appears to be the best for most computer-equipped North American hams.

The program that is currently used by the majority of those on HSCW in North America is *MS DSP* (see Figure 2).[7] This is a DOS-only program that uses the Creative Labs SoundBlaster-series sound cards to convert and record the received signal, save operator-marked pings, and allow the immediate playback of the saved signals at reduced speed (no tape recorders necessary!). The replay speed can be varied by a factor of up to 60 times, which could slow a 480 WPM ping down to as slow as 8 WPM, 1000 WPM ping down to about 16 WPM, or a 1700 WPM ping to about 30 WPM! It features an "up-converter" that heterodynes the very low audio pitch of the slowed-down CW note to a tone more easily heard. While the saved signals are being reviewed, this program is also transmitting the operator's data. The many functions of this program can be controlled by either the keyboard or mouse, and transmit speeds of up to 1700 WPM are possible. Data to be transmitted is

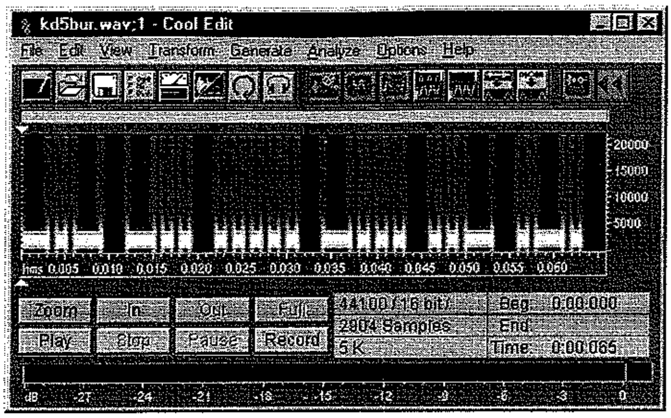


Figure 3—*CoolEdit 96*, an audio WAV file editor, allows the creation of files to be used during transmit periods. Here, my call has been assembled by pasting together the six individual character WAV files. A complete library of character files can be obtained as freeware from KØSM (see text).

Web Resources

Note: Server operation can vary. If you have difficulty connecting, try again later.

Meteors, MS, HSMS, Computers and Amateur Radio, **http://www.nitehawk.com/rasmit/ws1_15.html**

N1BUG Ham Radio World, **http://www.qsl.net/n1bug/**

N7STU HSCW page, **http://www.qsl.net/n7stu/hscw.html**

9A4GL homepage, **http://www.qsl.net/9a4gl/**

OH5IY homepage, **http://www.sci.fi/~oh5iy/**

KØSM HSCW page,**http://www.qsl.net/k0sm/ms.htm**

Make More Miles on VHF, **http://fs1.ilk.de/sites/gap**

W6AMT Meteor Scatter Page, **http://www.amt.org/Meteor%20Scatter/**

W3SE HSCW page, **http://www.qsl.net/w3se**

KBØVUK HSCW page, **http://www.qsl.net/kb0vuk/hsms.html**

WA6TBO page, **http://www.qsl.net/wa6tbo/hsms.htm**

simply typed in from the keyboard and may be modified at any time during the sked.

MS DSP produces its own keyed tones with the SoundBlaster audio board and thus does not require an external audio oscillator to drive the transmitter. Information on interfacing it with the transmitter, which may amount to no more than an audio line with a series capacitor, can be found on one or more Web sites.[4] This program runs under *DOS* 6.0 or higher only, although it may also run in a *DOS* window of *Windows 95* on some computers. It requires a '386 or better processor, 4 MB RAM, a VGA graphics card, and a Creative Labs SoundBlaster-series audio card. Like other DSP-type programs, this card must be a *true* SoundBlaster card. *Clones will not work!* Written by Tihomir Heidelberg, 9A4GL, *MS DSP* is available as shareware.[7] The version currently in use V. 0.51, is a beta version, with several known bugs in it. In particular, it will not run on a few seemingly compatible computers even with true SoundBlaster cards. In spite of the bugs, this has become the HSCW workhorse of the Western Hemisphere. 9A4GL is planning to write an entirely new version later this year, which will run under *Windows 95/NT* only. And as this article was going to press, it was announced that an entirely new *DOS* version was nearly ready for release in a beta version. This new version seems to have eliminated most of the bugs that plagued the previous releases, and it will also run under a full-screen *DOS* window of *Windows* 3.1x. It is expected that the improved and further enhanced *MS DSP* V. 6.x will probably be available on his Web site by the time this article is in print.

For those who cannot run *MS DSP*, a much simpler, receive-only program is *SBMS* (SoundBlaster Meteor Scatter), by DL3JIN.[8] A *DOS* program, it will also run in a full-screen window under *Windows* 3.1 (and probably *Windows 95*) and also requires a SoundBlaster board, although at least one clone has been found to work. This program does not have many of the "bells and whistles" of *MS DSP*, and it does not have a transmit (keying) section. But this was the program that started HSCW in North America, and it remains a good choice, especially if you already have a method of generating high speed code or have problems running *MS DSP*.

Another program in use is *CoolEdit 96*. This commercial product requires *Windows 95*, and is available in a shareware version direct from the Syntrillium homepage.[9] I decided to use *CoolEdit 96* simply because it was the easiest and fastest to get going for me. This is *not* an HSCW program, but allows you to manipulate audio WAV files in much the same way a paint program works with image files. It is an extremely handy addition to use with the other software packages we've discussed.

My Experiences

I began my foray into HSCW by downloading the individual files needed to build up the data I would need to transmit at the proper times. Next I customized the files for my station by opening and editing each one (Figure 3). I then made up a "switch-box" as suggested by Andy Flowers, KØSM (Figure 4). This is a basic computer-to-radio connection with a switch on the front that pulls the PTT line to ground. Finally, it was time to put everything together and see if it worked.

After tweaking the sound-card for a while, I was ready to conduct some local tests. I sent a blast of HSCW and a friend across town recorded my signal and played it back to me on FM simplex. It sounded unlike anything I had ever heard! My software processed it and there was my CW, as real as life. I felt like I was ready for the big test, a real sked via MS! One e-mail message was all it took. I would meet with Shelby Ennis, W8WN, on Monday and Thursday mornings.

Many of you have run schedules during the major meteor showers. For those who have not, a schedule or "sked" is an agreement between two stations that will attempt

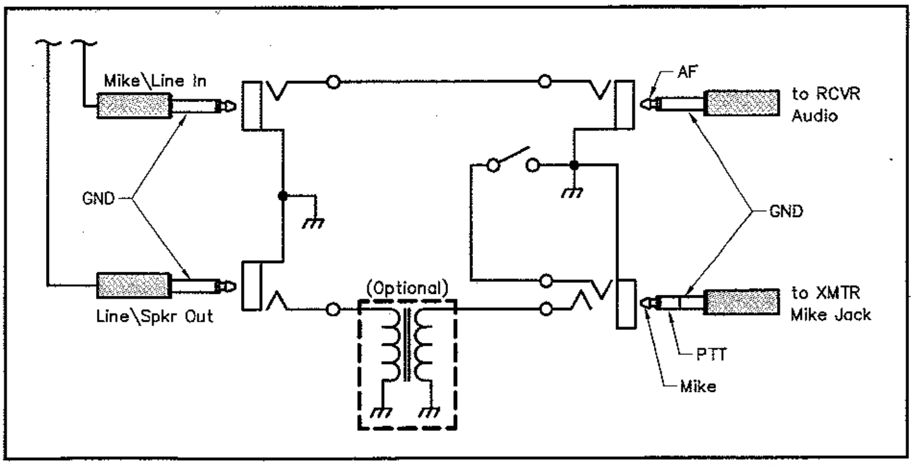


Figure 4—The HSCW interface box by KØSM. This is simply a way to organize the cables and place the PTT function at your fingertips. An optional isolation transformer (Radio Shack 273-1374) may be included. Shielded cable is preferred.

HSMS—Frequently Asked Questions

(Note that the procedures and standards discussed here are based upon North American HSCW operation, which sometimes differs from European HSCW MS).

What is HSCW?

HSCW (or HSMS) is the technique of using very-high-speed Morse code CW to communicate and exchange short bits of information by using the many underdense "pings" caused by tiny meteors that constantly bombard our atmosphere.

How does this differ from SSB meteor-scatter operation?

During the peak of a major shower, when overdense trails produce frequent signals for several seconds, short-sequence or break-in SSB may be more efficient. But at all other times, when overdense trails are not available, HSCW is able to use the occasional underdense fractional-second pings to transmit the information.

So just how short can these pings be and still get usable information across?

Very short! In fact, for HSCW, pings or bursts longer than two or three seconds are exciting but are almost a nuisance! We'll leave it up to you to do the actual math. But a 1/10 second ping can propagate a complete set of calls at the medium or higher speeds!

You can't copy that by ear! And the CW decoders I've seen couldn't handle anything like this.

Right. The idea is simple. Use a device (usually software) to slow the code down to a readable speed. Then copy it by ear.

So the machine does all the work?

Hardly! It takes the incoming signal, saves it, slows it down, plays it back at a slower speed (and possibly heterodynes it to a higher pitch for easier copying). The operator must still do the actual decoding of the signal. The computer or other device slows the speed down, but it is still up to the operator to dig it out of the noise and actually copy it! While a machine could no doubt be built to do this, the technical requirements would be very tight because most pings are few, weak, and very short. The brain substitutes for all of this expensive and unavailable equipment!

How do you key the transmitter?

Few rigs can be keyed in standard fashion at much more than 100 WPM; some won't sound good even that fast. The standard practice is to key a pure 2000-Hz audio tone and inject this into the mike jack.

So is this actually SSB, MCW or what?

It's CW, but with the zero-beat frequency offset from the dial reading by 2 kHz (with a 2000-Hz tone injected into the mike jack). Recall that on SSB, a single, continuous tone creates a steady output. Key this tone on and off and you effectively switch the rig's output between 100% (or whatever you have selected) and zero. That's the same as an on/off keyed CW signal!

You say your actual transmit frequency is offset from the dial reading? Isn't that confusing?

Yes, it can be, and this cannot be helped. But remember, when you switch a modern rig to CW, your signal is also shifted about 800 Hz off frequency.

I don't use a computer. Does this mean I can't work HSCW?

No! HSMS was popular among Europeans for many years before computers were in any of their ham shacks. For receiving, an inexpensive audio cassette tape recorder can be modified to record the CW at a high speed and play it back at a slower speed. The basic technique is to add a new motor speed control. The motor is then run as fast as possible while recording, then slowed down to play back the HSCW at slow speed. Using this method, you should be able to receive 1200 LPM, and some machines will work up to 2000 LPM. The CMOS Super Keyer 3 (*QST*, August 1995) works well for transmitting. Not having a computer is no reason to give up the idea of working HSMS!

Sounds fascinating, but I really don't know that much about meteor scatter itself.

Meteor scatter operation is unlike any other type of operation! If you are not familiar with it, you will have problems understanding what is being done on either SSB or HSCW MS. There are two articles that will help you understand meteor scatter. The primary article is "VHF Propagation by Meteor-Trail Ionization," by Walt Bain, W4LTU, published in the May 1974 *QST*, page 41. The second article is "VHF Meteor Scatter—An Astronomical Perspective," by Michael Owen, W9IP, published in the June 1986 *QST*, page 14. If you don't have access to *QSTs* going that far back, these two articles (plus many others on MS and most other types of VHF propagation) have been collected and reprinted in *Beyond Line of Sight*, edited by Emil Pocock, W3EP, and published by the ARRL. ARRL publications are available from your local ARRL dealer or directly from the ARRL. Mail orders to Publication Sales Dept, ARRL, 225 Main St, Newington, CT 06111-1494. You can call toll-free at tel 888-277-5289; fax your order to 860-594-0303; or send e-mail to **pubsales @arrl.org**. Check out the full ARRL publications line on the World Wide Web at **http://www.arrl.org/catalog**.

Is all HSCW meteor scatter on 2 meters only?

Most HSCW meteor scatter is done on 2 meters at the moment. A number of stations are setting up for HSCW operation on 50, 222 and 432 MHz. There is no reason why we cannot enjoy HSCW on all four of these bands. In fact, 6 meters would be a particularly good band for small, lower-powered stations (100 W or less) using omnidirectional antennas.

Does the Internet play a large role in modern HSCW operating?

Nearly all skeds are made using the Internet (via the HSCW Reflector, the "Hot Rocks" Web page, and several similar methods). The "Hot Rocks" page (and others in that series) has become very popular for making skeds in real time.

How many hams are currently active on HSCW in North America?

That's impossible to say because the list of active stations is growing rapidly. It started in North America with only two stations in June 1997, and has been growing at the rate of about two new stations each week since then. The most current list is found in the North American HSMS Directory on the Web at **http://www.qsl.net/n1bug/operate/hsmsdb.html**. By the way, when *you* become active on HSCW, go to the Directory site and add your station to the list!

What showers are good for running HSCW?

Showers? The Europeans have a saying, "We make our own showers!" They mean that there are so many on HSCW in Europe, and it is so effective in utilizing only the few random pings from sporadics, that they do more during non-shower periods than we usually do during major showers! Of course, having the extra meteors of a shower certainly helps. Not just the few "major" or most popular showers, but even the minor showers can be plenty of an enhancement for HSCW.

Why aren't the other digital modes used this way?

Good question. There would appear to be several reasons. Packet, as usually used on VHF, is a strong-signal mode. Even during the peaks of the biggest showers, it is next to impossible to complete a QSO using it (though it has been done a few times). Some of the more "robust" digital modes used on HF would appear to have a much better chance. But remember that with HSCW, you are dealing with only a few fractional-second pings near the noise level, during non-shower periods, any day of the year. As the late W1FZJ always said, "The best filter is the one between the ears." The human brain can take the place of whole racks of multi-megabuck equipment. HSCW allows the operator, with a little help from his computer, to make VHF DX contacts at times when nothing else can do it.

This may sound dumb, but could these HSCW programs help with an SSB meteor scatter sked?

Another good question! Many times it's difficult to be sure just what information was actually heard on a weak SSB ping. If you're alert enough to save it into a buffer of *MS DSP*, you then can immediately replay it (at normal speed, of course) to be sure of what you heard.

to contact each other at a specific time and frequency using meteor-scatter propagation. The contact is built around alternate transmit and receive periods with certain information passed back and forth as the QSO develops. For SSB and normal CW skeds, the transmit/receive periods are 15 seconds long. For the HSCW sked, the periods are one minute each. During the one minute transmit period the operator is reviewing the previous period's received data. If you're really coordinated, you can decode a burst while continuing to record the remainder of the receive period, then change your transmit information based on what you have received, thereby reducing the time to complete the QSO!

As the hour approached for the first schedule I became nervous. I opened up multiple copies of *CoolEdit 96* and loaded all the possible files I might need to transmit. I made sure the computer's clock was calibrated to WWV. I even made a test transmission to be sure all cables and settings were correct.

Standard North American MS procedures dictated that I transmit first. When the time came, I flipped the switch and began transmitting. The next one-minute period would be Shelby's turn to transmit and my turn to receive. When I flipped the switch to receive I instantly heard a long loud burst with the unmistakable sound of an HSCW signal. I was so shocked to hear his signal on the first receive period that I just about forgot everything I had been practicing to do! Using my software, I slowed down the audio and confirmed that it was Shelby's signal. My heart was pounding like a triphammer!

I transmitted my return burst of Morse, but something seemed wrong. After several more minutes of confusion, I discovered that I was transmitting the wrong data back to Shelby. By the time I figured out what I should do I was just about out of schedule time. Ultimately, it took about three skeds before I got all the procedures down and mastered the coordination to work through to a completion. Then I enjoyed working three HSCW stations in exactly three days—all new grids!

What I've Learned

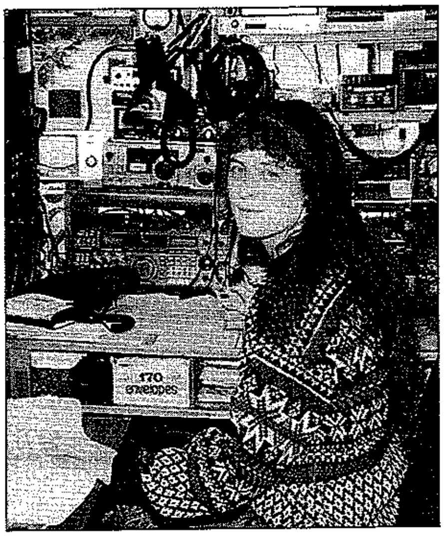
Since that time I have learned a great deal. While I have worked well-equipped stations capable even of moonbouce, I have also worked many smaller stations (like my own) running modest power and antennas. Suffice it to say, if your station is capable of working VHF troposcatter or regular SSB meteor scatter, you can run HSCW.

I need to point out, though, that monitoring for on-the-air signals is not easy. The HSCW calling frequency is 144.100 MHz, ±2 kHz. Activity levels in the US are still low; and with HSCW operators spread over the continent, they typically use schedules. Waiting to randomly catch a burst may be harder than working an actual sked. On weekends and early morning hours during the week, you can follow the activity on the MS ROCKS Web site where operators sometimes line up schedules in real time.[10] You may also find announcements when an operator plans to call CQ. If you are located the right distance and direction from a station calling CQ or working a sked, you should be able to monitor the exchange. At this time, most schedules are made by e-mail. As activity increases, random contacts will become more common as is now the case in Europe.

Another thing that I found was that practicing the mechanics of a schedule was helpful—but nothing compares to running actual skeds. The more the better! The basic one-minute protocol is essentially the same as for any other MS operation, but required data for a complete QSO must be understood as well as the procedures in regard to frequency settings. My best advice to you is that if you are in doubt about how to do something, simply ask your sked partner.

An excellent way to get acquainted with the sound and "feel" of HSCW is to download "ping practice" WAV files from the several Internet sites offering them.[11] These files can be played at full speed by any wave file player; but to copy the code contained in the ping, you will need one of the programs mentioned above. See Figure 5 for a *CoolEdit 96*

HSCW Meteor Scatter Records are Made to be Broken!



In the accompanying photograph, Valerie Brady, WD8KVD, sits at the controls of the station of Shelby Ennis, W8WN, where she recently set a new HSCW record. Visiting during the Christmas holidays, Val was invited to take over as the operator during the daily 15-minute HSCW sked conducted each morning between her dad, Shelby Ennis, W8WN, and Steve Harrison, KO0U/1. Valerie had never been interested in CW, although she had passed the 13-WPM test for her General license nearly 20 years ago. After practicing for only 15 minutes with the popular HSCW program *MS DSP*, she found that not only could she handle the program, but she could copy the typical short meteor-scatter-type sequences at 15-20 WPM.

Challenged to become the first YL in North America to make a HSCW QSO, she completed not one, but two successful schedules with Steve Harrison, KO0U/1, in as many days. Both skeds were run at a slightly faster-than-normal speed of 5000 LPM (1000 WPM). Val and Steve then decided to go for the world record! Shelby and Steve held the previous record, set at a speed of 8500 LPM. Val removed all spaces from her transmit sequences that would yield a speed of about 8600 LPM (1720 WPM)!

The morning of the sked found good conditions with numerous "pings," but the increase in speed also reduced the S/N ratio making for difficult copy. In spite of this the world record sked lasted a mere 17 minutes with a final "73" and "TNX VAL CUL" message from KO0U/1. Asked how it was that she handled the CW so easily, she said, "What did you expect? I'm a girl! Of course it was easy!"

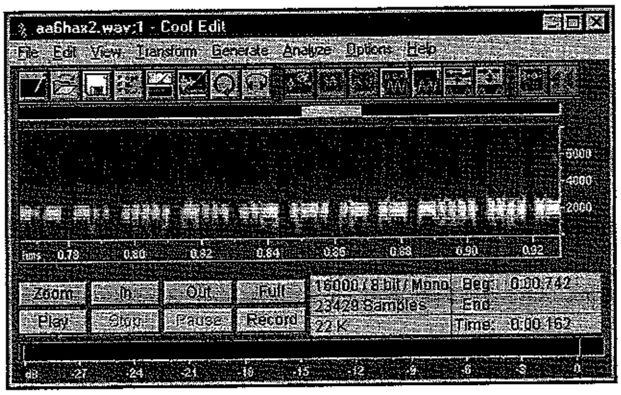


Figure 5—*CoolEdit 96* displays a received burst from a sked between KD5BUR and AA6HA. This portion of the burst is 170 ms long and shows the signal increasing in strength. The first action with a *CoolEdit 96* recording is to "paint" the approximate area of the window where the ping or burst is located. Then by using the **ZOOM** and **IN/OUT** buttons, the time scale is expanded to find the code characters.

display of the burst recorded during a sked between AA6HA and KD5BUR. Can you see the characters?

Conclusion

What is the average HSCW experience like? The likelihood of completing a schedule varies from very low to very high. If it is estimated that you have a 10% chance of completing a given SSB meteor-scatter sked, you probably have a *90%* chance of completing one with HSCW. I work some stations on the very first try while others have required several skeds. Unless attempting an extreme-distance contact, I almost always copy some amount of HSCW data. Ilkka Yrjola, OH5IY, reveals the challenge of meteor scatter in general with his table of "25 things that have an effect on MS reflections." He wrote, "Only a few of these are constants. A couple of the parameters are known at ±20% accuracy, a couple of them vary a lot and one (or many) that cannot be pre-determined at all." Knowing the odds against a signal reflection reaching my sked partner's antenna from a grain of sand burning up at just the right spot in the sky makes me marvel at the high degree of success we enjoy!

By now I hope that you are ready to learn more and eventually become active on HSCW. Check out the Web sites listed for more information (and follow their links to some of the other fine VHF DX Web sites). If you live within 1000 miles or so of grid square EM23, I hope you will schedule a contact with me. I also work SSB MS skeds and would be glad to confirm this grid for you!

High speed CW is fun. It requires a dose of patience, a little bit of study and practice, and sharp operating skills—all the things I think hamming is about. Best of luck, and may you have "good reflections!"

Notes

[1]Joe Mutter, PAØJMV, in a letter to Shelby Ennis, Sept. 4, 1997, **http://www.nitehawk.com/rasmit/hsms70.html.**

[2]Ed Tilton, W1HDQ, "The Earliest Efforts on 144 MHz Meteor Scatter," *QST*, October 1954, and Ken Willis, G8VR, "Meteor Scatter—European Style," *QST*, November 1986.

[3]John, PE1OGF, in a letter to Shelby Ennis, Sept. 4, 1997, **http://www.nitehawk.com/rasmit/hsms71.html.**

[4]N1BUG Circuits for HSCW, **http://www.qsl.net/n1bug/tech/hsms-cir.html**

[5]*MSSOFT* software, **http://www.sci.fi/~oh5iy/.**

[6]**http://www.qsl.net/n7stu/hscw.html**

[7]9A4GL homepage, **http://www.qsl.net/9a4gl/**

[8]**http://www.ilk.de/sites/gap/msound.htm**

[9]Syntrillium homepage, **http://www.syntrillium.com/10/cool.htm**

[10]MSROCKS Web page, **http://www.cybercomm.net/cgi-bin/cgiwrap/~slapshot/msrocks.sh**

[11]KD5BUR HSCW page, **http://www.qsl.net/kd5bur/**

New Books

VHF/UHF HANDBOOK

Edited by Dick Biddulph, G8DPS

Published by the Radio Society of Great Britain (RSGB). Soft cover, 10 11/16 × 8 3/4, B&W illus and photos, 317 pages, ISBN 1 872309 42 9. Available from the ARRL, $35 plus shipping. Order Item 6559. Also available directly from the RSGB and at selected retailers.

Reviewed by Paul Danzer, N1II
ARRL Technical Advisor

Imagine a radio amateur's handbook, devoted entirely to VHF and UHF. That's what is in this latest RSGB edition. The preceding edition was first published in 1969, and reprinted as recently as 1994. This new edition was published in 1997, and consists of 12 chapters and several appendices.

Unlike its predecessor, there is no microwave chapter. A separate series of RSGB books now cover microwaves. Each chapter was written by a different author or authors, making this book the work of 15 people, according to the listing at the front of the book.

This book contains material at all levels, from beginners to advanced experimenters. A very readable introduction includes several interesting stories, including a tale that ties the under-30 MHz Morse code requirement to the need of early commercial stations to tell amateurs to clear off a frequency—but only in code!

A second introductory chapter, Getting Started, is directed toward those who are interested in trying VHF/UHF operation for the first time. US readers take note: a good bit of this material is directed toward UK hams, their laws and requirements.

Not so in the succeeding chapter—Propagation. Interested in the effect of weather and propagation on line-of-sight propagation? How about ducting, refractive indices, extracting meteorological data from broadcasts? Radiosonde ascent data and tepigrams? A total of 36 pages of propagation-related information, including several reference charts, is included.

The largest chapter, 85 pages, is devoted to receivers, transmitters and transceivers. As you might expect, the material is heavy on signal-to-noise considerations, tuned cavities, microstrip construction, and all the technologies that contribute to a modern VHF or UHF station. Both US and UK sources are used for this material and for the 88-item reference listing. PC board layouts are supplied at 1:1 size in an appendix.

The antenna and transmission lines chapter follows the hardware chapter, and provides a compact survey of what you might like to know for antennas in this frequency range. The illustrations are reasonably clear, and there are a few paragraphs on building you own helical whip (rubber ducky).

An EMC chapter contains some material of interest to the US ham, but several of the sections are directed, as you might expect, to commercial filters and parts that match the various telephones and appliances found in the UK. The various standards and specifications discussed will be unfamiliar to most US hams, although the problems and the general cures are very applicable, independent of your location.

Brief chapters cover data modes, ATV and repeaters. The CTCSS tone encode chart is interesting, and makes you wonder just how so many repeaters can work in a relatively small area.

The test equipment chapter is really for home-brewers. Bridges, dummy loads, RF voltmeters, attenuators—all are shown with clear illustrations to help you build your next test instrument. Even a VHF FET dip oscillator is included. The parts designations will not be found in US catalogs, but by reading the text you can pretty well guess what the requirements are for US component substitution.

If you are interested in UHF and VHF, especially with a view toward home-brewing, take a look at the *VHF/UHF Handbook.* You won't go wrong.

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