By Dennis Bodson, W4PWF, and Steven Karty, N5SK

FAX480 and SSTV Interfaces and Software

Want to operate fax and SSTV? You've come to the right place! With free software and less than $15 in parts, you'll be on your way!

FAX480 is a new *national standard* for sending facsimile (fax) over HF radio. Because *software* does most of the processing work with simple interfaces, anyone with at least an 80286 computer can build a fax and SSTV interface for less than $15 worth of parts.

A Fax Standard Found

The National Communications System (NCS),[1] a federal government organization, recognized that fax transmission over HF radio was limited by the lack of an official standard. To achieve interoperability in this area, the NCS was required to standardize HF fax transmissions for federal government departments and agencies. When FAX480 was introduced by Ralph Taggart, WB8DQT,[2] the NCS recognized its benefits. The NCS also realized that establishing FAX480 as a national standard would further its use and acceptance. Following revision[3] and resubmission for industry ballot, FAX480 was approved as a new Telecommunications Industry Association (TIA)/American National Standards Institute (ANSI) standard.[4,5] Here, we'll highlight several FAX480 implementations and provide you with a host of information resources.

[1]Notes appear on page 35.

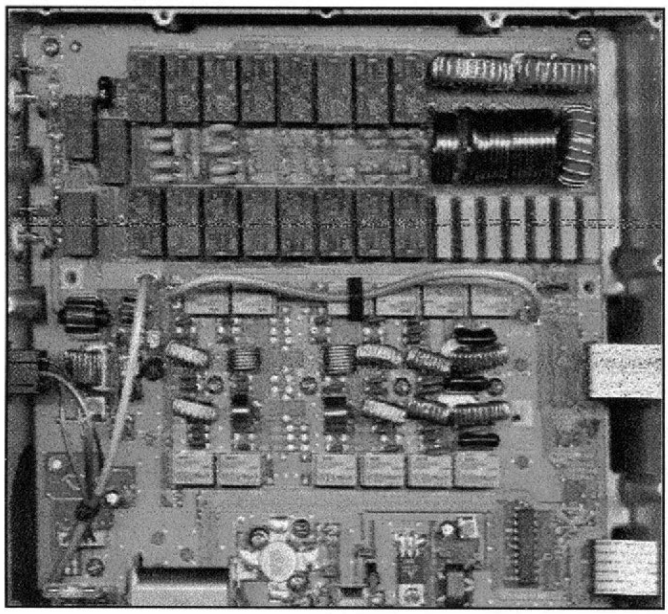
FAX480—What's the Diff?

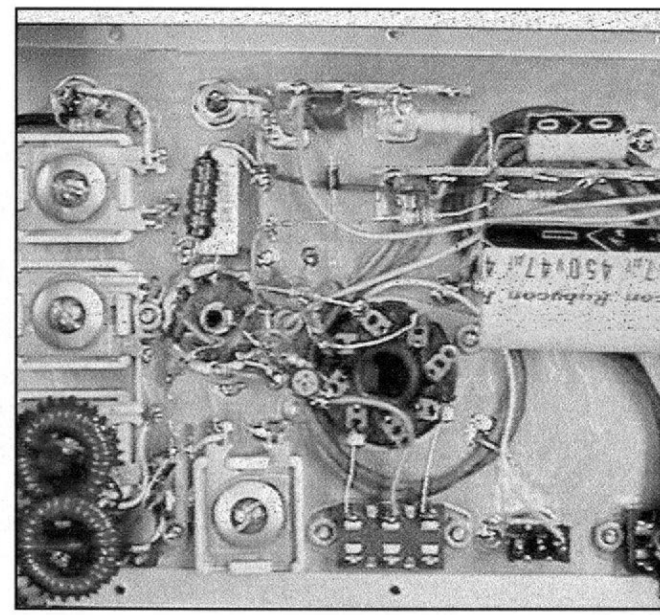
FAX480 *doubles* the number of horizontal scanning lines used in conventional 240-line SSTV for sending gray-scale images. It offers improved resolution by taking advantage of computers equipped with VGA displays. Compared to color SSTV modes, FAX480 has better resolution and resistance to noise and multipath distortion.

Like most other Amateur Radio implementations of fax and SSTV, FAX480 transmits black and white pixels as audio frequencies of 1500 Hz and 2300 Hz, respectively. Gray-scale values are represented by frequencies between the black and white limits, while 1200 Hz is used as a synchronization (sync) frequency (blacker than black). Usually originating from IBM PC-compatibles, FAX480 images are often photographic (continuous tone) having at least 16 scales of gray. The 480-line image can be displayed using the 640×480 VGA mode available with most '286 and later computers.

Transmission Format

A FAX480 transmission begins with al-





Example FAX480 images: At left, an interior view of a modern rig. At right, under the chassis of a vacuum-tube CW rig.

most five seconds of a start pattern that alternates between the black and white frequencies at a 244 Hz rate. Next are 20 *phasing lines*—5.12 ms of sync at the beginning of each phasing line followed by 262.144 ms of white—that provide vertical (frame) sync. These phasing lines are followed by 480 *image lines*, each beginning with 5.12 ms of sync followed by 262.144 ms of display video. Providing sync for each horizontal image line makes it possible for a receiving system to lock on a picture *even if the frame sync is missed.* (This operation is similar to the Scottie and Martin SSTV modes.) Other fax formats—which typically use only frame sync without any line sync—*miss an entire frame* if they miss the beginning of a transmission (or fail to achieve frame sync for any other reason), even if they correctly receive all of the image lines!

FAX480 was first used with the ViewPort VGA Slow-Scan TV System produced by A&A Engineering.[6, 7] Since then, several other SSTV sources[8-16] have added FAX480 capability to their software. Two of these programs[14, 15] run on an 80486 computer equipped with a Sound Blaster-compatible board. Ben Vester, K3BC, developed software that runs on an 80286 computer and uses a simple, single-op amp interface. *Pasokon TV Lite* and *EZ SSTV*[11] use a variation of Vester's interface. *ProSkan* currently uses this version of the interface only for *receiving* FAX480. More-complicated hardware interfaces are available, too.[11,16] VGA video displays and IBM PC-compatible computers are required for all of the implementations, and all of the software handles additional fax and SSTV modes.

Simple Clipper Interfaces

A simple radio/PC interface can be built easily with less than $15 worth of readily available parts. It's simple because *software* does the processing work previously done by more-expensive hardware. Although other, more-sophisticated interfaces (such as those using Sound Blaster-compatible boards) may offer more signal filtering, the simple interface provides excellent results. It's often referred to as the "HamCom" or "HamComm" interface. This may result in some confusion because *HamComm* is also the name of a program that handles RTTY, AMTOR, CW, ASCII and PACTOR receive (but not fax or SSTV) and uses a similar interface.[17]

The simple interface (see Figure 1) is a *limiter* circuit, just like those in an FM radio. It uses an op amp (such as a 741) to turn the incoming audio tones into square waves of at least 16 V P-P (centered around 0 V) and place them on one of the computer's serial interface (RS-232 or COM port) input lines. Because the op amp runs at extremely high gain, its output is effectively slammed from one supply voltage rail to the other with each signal cycle, thereby creating square waves. By measuring the time between signal zero-crossings, the software determines the received-signal frequency, and transforms that into an intensity (or brightness level) that it applies to the particular pixel.

Power to operate the op amp is derived from two of the RS-232 interface lines. Some versions of the simple interface provide transmit capability. Transmit data is capacitively coupled from one serial-port output line to the transceiver's microphone connector. When the square-wave signal from the computer passes through the transceiver's IF filter, the signal's sharp edges are removed resulting in approximate sine waves.

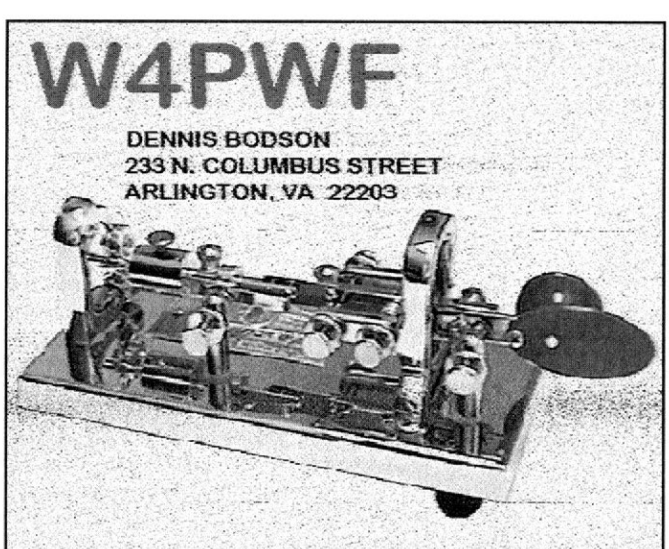
Other simple interfaces don't inherently provide transmit capability, but you can add it. Merely connect the computer's speaker leads through an isolation transformer to the transmitter's audio-input jack. Other interface/software combinations allow you to select the computer's internal speaker or a serial-port pin as the transmit data source.

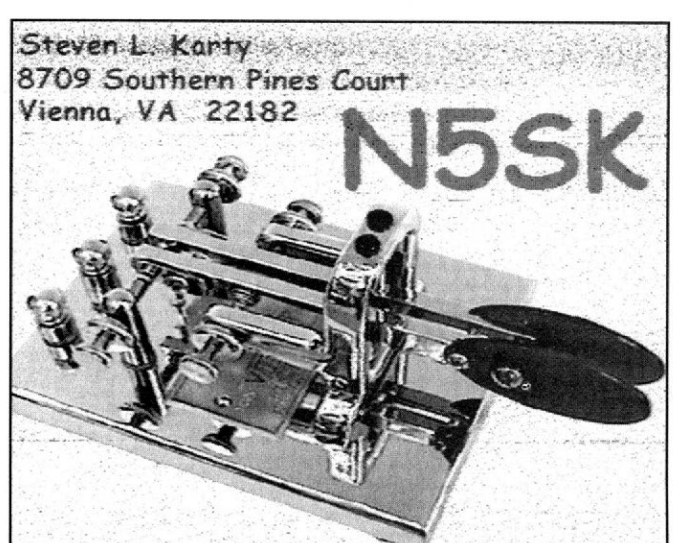
Some History

The idea of using a home computer to copy HF weatherfax signals originated with Keith Sueker, W3VF, in 1986.[18] His interface uses a clipper followed by a one-bit analog-to-digital converter, so it provides only a black-and-white rendition (no gray scale). In May 1987, Ben Vester, K3BC, added the computer's internal time clock count to act as an off-line reference for line timing that is independent of CPU speed and the vagaries of printer speeds.[19] In 1988, Vester introduced a technique for getting gray-scale renditions of fax images using the simple interface and measuring the frequency of the audio signal by counting the number of clock pulses between the signal zero crossings. He explained his software's operation in a January 1988 *QST* article.[20] Vester's September 1991 *QST* article[21] shows the IBM PC-compatible version of his simple interface for receiving weather facsimile. His January 1994 *QST* article[8] adds SSTV and fax, and a transmit capability for those modes.

Sueker's and Vester's contributions are significant because they use only a computer to demodulate the FM signals, provide the precise synchronization timing control (with no external oscillators for sync) and process and display the received data. Because early fax and SSTV systems used a computer *for display only*, they required external demodulators costing about $200.

Simple clipper interface circuits can be used with the Vester, *Pasokon TV Lite* and *EZ SSTV* programs for transmitting and receiving FAX480, and with the *ProSkan* software program for receiving FAX480. There are two versions of the clipper interface: One for use with Vester's software, another for use with other programs. The primary difference between them is that Vester's interface uses the Transmit Data (TxD) and Request to Send (RTS) lines of the computer's serial port to provide the negative supply voltage and the transmit data, respectively; most other clipper interfaces swap these two lines. Therefore, be certain to use the appropriate interface with each software package or provide a means





FAX480 QSL cards made from images available at **http://www.vibroplex.com**.

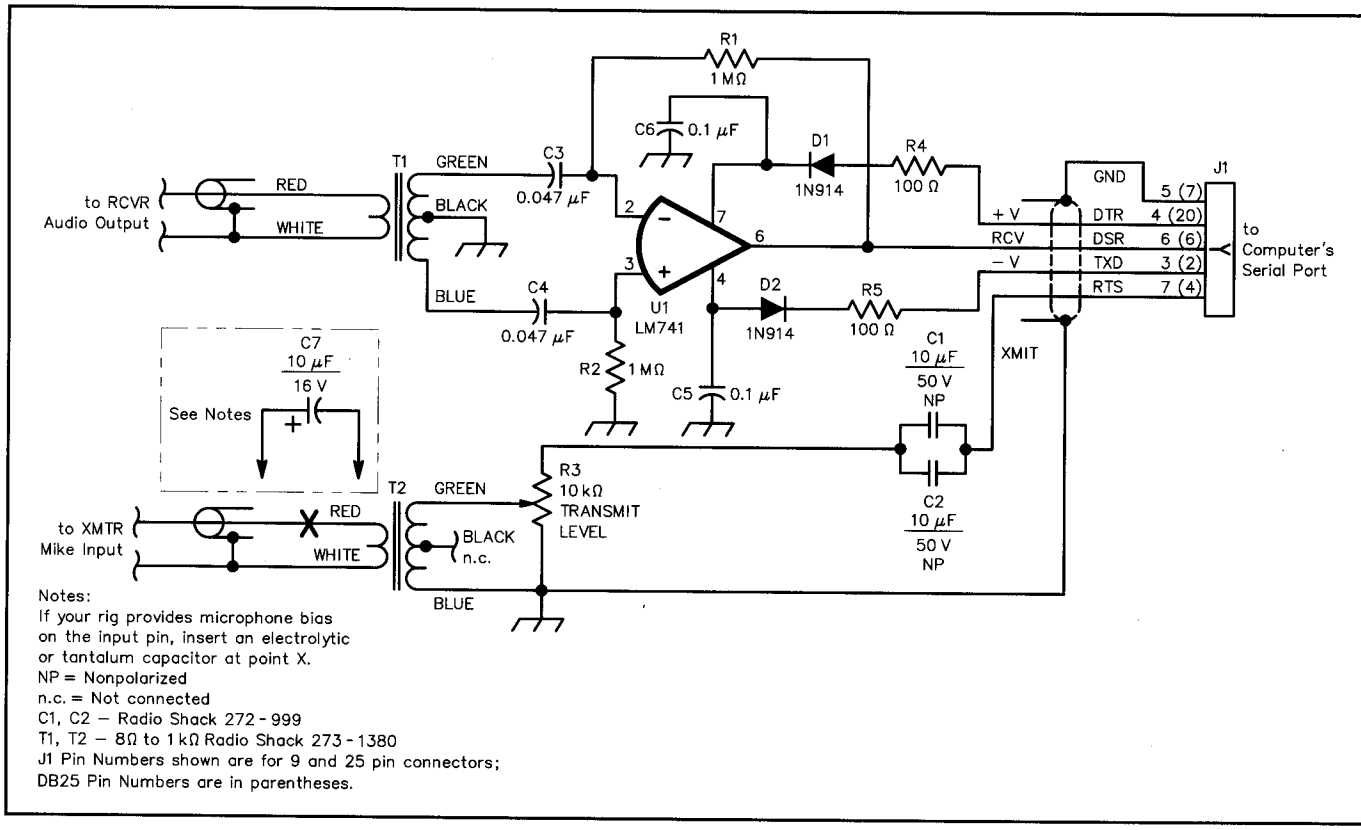


Figure 1—Schematic of the Vester simple clipper interface which requires the Vester software identified in Note 9. The TXD and RTS lines must be swapped if this interface is used with other software programs (see text). Unless otherwise specified, resistors are 1/4 W, 5% tolerance carbon-composition or film units. The transformers are used to protect the PC from stray currents that might damage motherboard signal or ground traces.

C1, C2—10 μF, 50 V nonpolarized (Radio Shack 272-999)
J1—DB9 or DB25 connector
R3—10 kΩ potentiometer
T1, T2—8 Ω to 1 kΩ audio transformer (Radio Shack 273-1380)

of switching the two lines.

Other interface differences are minor, with various combinations of transformer coupling, VOX or PTT, and transmit-data low-pass-filtering used in some circuits and not others. Vester's interface uses transformer coupling to provide isolation and hum cancellation.

Most ready-built simple interfaces[13] are housed in the hood of a DB25 connector. Because many computers use DB9 connectors for their serial ports, a DB9-to-DB25 adapter is usually required. Regardless of which interface you use, add input and output coupling transformers to the transceiver's transmit and receive audio lines (Vester's interface already has them). The transformers protect your PC from stray ground currents that might damage its motherboard's signal or ground traces.

Our Choice

We recommend building the Vester interface because: It is the least-expensive way of starting out in fax or SSTV; the software is free and will even run on a '286 computer. Figure 1 shows an updated interface schematic based on one Vester originally presented in January 1994. It is also helpful to read Vester's other *QST* articles before building an interface. [22, 23]

Vester suggests[24] adding four diodes and resistors to the receiving part of his interface so it will work with any receive software, regardless of which of the computer's serial-port output pins are used for power. This works well if you use the computer's internal speaker for transmit output. If the computer's serial port output is used for transmit, a switch is required to swap the TxD and RTS lines when changing software. We experienced no problems with the simple Vester interface. It took only a day to build and worked properly as soon as we connected it correctly. It was certainly much easier to find parts for that interface and build it than a simple RTTY terminal unit we built in 1960!

K3BC's Software

Working part-time, it took us a couple of weeks to read all of Vester's articles and get the software running on a '286 clone. We spent much of this time rereading the 70-plus pages of documentation, scattered throughout more than a dozen files that accompany the software. To run Vester's software, you might have to add the name of the directory containing *GWBASIC.EXE* to your computer's *AUTOEXEC.BAT* PATH statement.

Vester's automatic identification routine determined that our old Super VGA video card is not VESA compliant. We used another computer to find the video card manufacturer's Web site, then downloaded the VESA driver (a TSR program) for the card. New video cards are usually VESA compliant, so they do not need an extra driver.

Once we added the command to run this video driver to the first line of several existing batch files in Vester's software, we proceeded with the initialization program that displayed the correct parameters for the video card. The second part of the installation program guided us through a dozen additional sections of the program where we manually entered the video-card parameters.

File Conversion Problem

We were unable to get *Alchemy* (included with Vester's software) to convert a GIF file into the appropriate format for transmission. *Alchemy* reported it was converting the file and writing it to disk, but we couldn't find the file—not even an empty file! After downloading *LVIEWPRO*[25] (version 1.D for *Windows 95*) from the Internet, we used it to view the GIF file. Because *LVIEWPRO* reports the file size, we identified the problem easily: The GIF file exceeded the 640×480 size limit of *Alchemy*'s demonstration version.

LVIEWPRO also made it easy to

redimension the GIF file to fit the *Alchemy* limits. The redimensioned file worked well, once we discovered that Vester's software uses 546×480 as the FAX480 picture size. Because Vester's software does not use *Alchemy* on TIF files, we could have used *LVIEWPRO* to convert the original file directly to a 546×480 TIF file, bypassing *Alchemy*'s upper limit.

Vester Enhancements to FAX480

Through skillful programming, Vester achieved the accuracy required to transmit and receive FAX480 *without using an external crystal oscillator*. The software takes advantage of the horizontal-line sync, locking on the first one detected, then flywheeling through the rest of the picture. This approach adds the advantage of allowing *manual syncing* well after the picture has started.

It takes about two minutes and 18 seconds to send each black-and-white FAX480 image. Vester has an additional version of FAX480 that saves about 10 seconds of transmission time by replacing the lengthy FAX480 start signal and phasing lines with a vertical-interval-signaling (VIS) combination. Using VIS allows automatic operation, just like the SSTV modes. Vester's software also provides automatic picture storage for unattended reception when using VIS. In addition to the VIS version of the black-and-white FAX480, Vester has added a TRUCOLOR version of FAX480 that he calls *Colorfax*. *Colorfax* has the same line timing as FAX480, and uses the same line-sequential format common to other SSTV color modes. All FAX480 versions are easily accessible from the menu screen, so compatibility is maintained with the original implementation. The NCS will update the FAX480 standard to include these additional Vester software versions.

Additional Information

If you're looking for fax and SSTV signals to copy, the best frequencies seem to be 14.230 and 14.233 MHz. You may also find activity on: 1.916, 3.845, 3.856, 3.857, 7.171, 7.173, 21.340 and 28.680 MHz.

Transceiver and interface interconnection diagrams for many different brands and models of transceivers are available.[26] These diagrams are helpful in deciding whether to use the transceiver's back panel connectors or its microphone and speaker connections. Although these diagrams are intended primarily for interconnecting transceivers with TNCs, the transceiver's audio connections are the same for the clipper interfaces.

Summary

Much of the progress made in reducing the cost of getting started with fax and SSTV is directly attributable to Ben Vester, K3BC, who has written so much software for handling those modes. It's helpful that Vester's software is available as *freeware*, and that it will run even on a '286 computer. If you have a '486 or better computer in your shack, we recommend you also try John Langner's *EZ SSTV* and *Pasokon TV Lite* programs.[11] It appears that Langner's programs would generally be easier to get running than Vester's, because their installation procedures are simpler and they don't require as much knowledge of DOS. And try *WinPix Pro*[15] if you have a '486/66 or better computer with a Sound Blaster-compatible board.

Notes

[1]See the NCS Web site at **http://www.ncs.gov**.

[2]Ralph Taggart, WB8DQT, "A New Standard for Amateur Radio Analog Facsimile," *QST*, Feb 1993, pp 31-36. Taggart's Web site **http://taggart.glg.msu.edu/fax480.htm** is specifically devoted to FAX480.

[3]TR-29 Facsimile Systems and Equipment Engineering Committee, *Document TR-29/95-11-68R1, Draft Standard, High Frequency Radio Facsimile, SP-3394*, Jul 28, 1995.

[4]TR-29 Facsimile Systems and Equipment Engineering Committee, *Document TIA-668, Standard, High Frequency Radio Facsimile*, Aug 31, 1995.

[5]National Communications System *Technical Information Bulletin 96-3, High Frequency Radio Facsimile*, Jan 1996.

[6]Ralph Taggart, WB8DQT, "A&A Engineering ViewPort VGA Slow-Scan TV System," *QST*, Feb 1993, pp 72-74.

[7]The ViewPort VGA is available from A&A Engineering, 2521 W La Palma, Unit #K, Anaheim, CA 92801; tel 714-952-2114. Price: $149.95 (kit), or $179.95 (assembled), plus shipping. An optional, built-in LED tuning aid is available for $30 extra. (The ViewPort VGA interface originally required an optional clock board to provide FAX480, but A&A has since made it standard.) The ViewPort provides 16 gray scales when operated in its FAX480 mode.

[8]Ben Vester, K3BC, "An Inexpensive SSTV System," *QST*, Jan 1994, pp 27-29. In Figure 1, page 28, the J1 pin labeled CTS should be RTS, and identified as pin 7 of a DB9 connector, or pin 4 of a DB25 connector (see Feedback, *QST*, Feb 1994, p 77). This article shows Vester's simple clipper interface, which is similar to those used with *Pasokon Lite*, *EZ SSTV* and *ProSkan*, except for interchanging the RTS and TxD signal lines. The Vester interface requires the software identified in Note 9.

[9]Vester freeware, which runs under DOS and requires *GWBASIC*, is available on the Internet from **ftp://oak.oakland.edu/pub/hamradio/arrl/bbs/programs**. Scroll down the page and click on **vester_n.zip**. Use *PKUNZIP.EXE* (or a similar program) to unzip this file to a floppy disk (which becomes the installation disk), change to the floppy disk drive, type **INSTALL** and press **ENTER**. *GWBASIC.EXE* is available on the original disks for most versions of MS-DOS 3 and 4. A Web search for *GWBASIC.EXE* should produce a listing of sites from which this program can be downloaded.

[10]John Langner, WB2OSZ, "Slow-Scan TV—It Isn't Expensive Anymore!" *QST*, Jan 1993, pp 20-30. The article shows John Langner's Pasokon TV classic interface board that plugs into a '386 or faster computer.

[11]The Pasokon TV Classic Board, assembled and tested, including software, costs $200 plus $5 shipping. A separate product, *Pasokon TV Lite* software, uses the simple clipper interface (instead of the Pasokon TV Classic Board): $30 plus $3 shipping. The Pasokon TV Classic Board and *Pasokon TV Lite* software are available from John Langner, WB2OSZ, Absolute Value Systems, 115 Stedman Street #Q, Chelmsford, MA 01824-1823; tel 978-250-0611; e-mail **johnL@world.std.com**; Web site **http://www.ultranet.com/~sstv**. A demonstration version of *Pasokon TV Lite* called *EZ SSTV* is available at **http://www.ultranet.com/~sstv/ezsstv.html**.

[12]Construction information for simple clipper interfaces usable with the *Pasokon TV Lite*, *EZ SSTV*, and *ProSkan* software is available on the Internet at

http://www.accessone.com/~tmayhan
http://home1.inet.tele.dk/oz9au/sstvpix5.htm
http://home1.inet.tele.dk/oz9au/sstvpix9.htm
http://home1.inet.tele.dk/oz9au/sstvpix12.htm
http://home1.inet.tele.dk/oz9au/sstvpix13.htm
http://home1.inet.tele.dk/oz9au/sstvpix16.htm
http://ourworld.compuserve.com/homepages/HFFAX/decoder.gif
http://www.mygale.org/02/sylvainb/sstv/inter.html

Most of these interfaces identified at these sites can also be used with the Vester software, if their RTS and TxD lines are interchanged.

[13]There are several ready-built versions of the simple clipper interface, but all require their RTS and TxD lines to be interchanged for use with Vester's software. This can easily be done by rewiring a DB25-to-DB9 adapter, because most of the clipper interfaces are equipped with DB25 connectors and more recent computers are equipped with DB9 serial port connectors. The following interfaces are wired for use with the *Pasokon TV Lite*, *EZ SSTV* and *ProSkan* programs:

The HCD decoder ($19.95 plus $3 shipping), available from Dave Evangelista, N2TRY, PO Box 1164, Radcliff, KY 40159; e-mail **n2try@radioamateur.com**; Web site **http://www.radioamateur.com/hamcom.htm**. For transmitting with this interface, the transceiver's audio input must be connected through an isolation transformer to the computer's internal speaker leads.

MFJ-1213 computer interface, $29.95 plus $6 shipping is available from MFJ Enterprises, PO Box 494, Mississippi State, MS 39762; tel 601-323-0549; e-mail **jshurden@mfjenterprises.com**; Web site **http://www.mfjenterprises.com/mfj/compint/mfj1213.html**. For transmitting, the transceiver's audio input must be connected to the computer's internal speaker leads through an isolation transformer.

David Gillespie, WA4LLR, Image the Earth, PO Box 788, Micaville, NC 28755; tel 704-675-9942; e-mail **WA4LLR@juno.com** offers several products: The RWC1 WEFAX/SSTV Receiving Converter for $29.95 plus $5 shipping. This unit requires the transceiver's audio input be connected to the computer's internal speaker leads through an isolation transformer to transmit. Or, the TX-1 Transmit Adapter (an additional $19.95) can be used. The FC1-RX WEFAX/SSTV Transmit/Receive Converter for $59.95 plus $5 shipping is also available. Grove Enterprises is a distributor of these products. Contact them at 7540 Hwy 64 W, Brasstown, NC 28902; tel 704-837-9200; e-mail **order@grove.net**; Web site **http://www.grove.net/~image**.

Elmer West, W4OD, 6526 Creekview Terr, Pinellas Park, FL 33781; tel 813-544-6380; e-mail **Elmer2@gate.net**, sells a simple clipper interface (made by Gregory Chamberlin, N4XQU) for $30 + $3 shipping. This interface is the same as Jamie Philbrook's (see Note 14); it receives and transmits and includes a built-in PTT circuit and an adjustable transmit-level potentiometer.

John Bryson, N7DME, at Tuccomm, 8555 E Beverly St, Tucson, AZ 85710 offers the TUC-1 interface for $35 plus $3.50 shipping; tel 520-721-0323; e-mail **jbryson@dakotacom.net**; Web site **http://www.wp.com/tuccomm**. This interface is similar to Jamie Philbrook's (see Note 14); it receives and transmits, and includes a built-in PTT circuit and an adjustable transmit output-level potentiometer.

Tigertronics, PO Box 5210 Grants Pass, OR 97527 sells the BayPac Model BP-2M MultiMode Modem for $69.95 plus $5 shipping; tel 541-474-6702; e-mail **tiger@tigertronics.com**; Web site **http://www.tigertronics.com**. This interface (which uses a custom ASIC) receives, transmits and includes a built-in PTT circuit and an adjustable transmit-level potentiometer.

[14]These implementations are *receive only* for

FAX480: *ProSkan for DOS* and *WinSkan for Windows* are available from Maynard A. (Jamie) Philbrook, Jr, KA1LPA, at PC Bit Soft-Ware, 520 Pleasant St, Willimantic, CT 06226; tel 860-456-1167 and 860-456-2521; e-mail **jamie@cyberzone.net**. *ProSkan* costs $42.50; *WinSkan* costs $60 (both prices include shipping). Shareware versions of *ProSkan* and *WinSkan* are available from his Web sites: **http://www.mindport.net/~jamie** and **http://cyberzone.net/jamie**. *ProSkan* requires a simple clipper interface (such as the one using a TL082 dual op amp shown in the *ps-board.pcx* file that comes with the *ProSkan* software) and an 80386DX-33 or faster computer with at least a 32-k color card, but is *incompatible* with ATI video cards. *WinSkan* requires a Sound Blaster-compatible board in an 80486DX2-66 or faster computer equipped with a 32-k color card (minimum).

[15]*WinPix Pro* software, which runs on an 80486/66 MHz or better computer with a Sound Blaster-compatible board, costs $109, plus $5 shipping and handling. *WinPix Pro* is available from G. V. Associates, Don Rotier, KØHEO, 2440 Hamline Ave, St Paul, MN 55113; tel 612-633-5928; e-mail **kØheo@skypoint.com**; Web site **http://www.skypoint.com/~kØheo**.

[16]PC HF fax is an external interface available from Software Systems Consulting, 615 S El Camino Real, San Clemente, CA 92672; tel 714-498-5784; e-mail **Support@ssccorp.com**; Web site **http://www.ssccorp.com**. The *FAXPL* (receive only) version is $129.95, the *FSXMT* (transmit option) is an additional $50. Shipping is $7 extra. These prices include the hardware interface and the software.

[17]Terry Mayhan, K7SZL, "VolksRTTY—An Improved *HamComm* Interface," *QST*, Apr 1998, pp 46-50.

[18]Keith Sueker, W3VF, "Real-Time HF WEFAX Maps on a Dot-Matrix Printer," *QST*, Mar 1986, pp 15-20.

[19]Ben Vester, K3BC, "HF WEFAX for the IBM PC, PC*jr* and C64," Technical Correspondence, *QST*, May 1987, pp 40-43.

[20]Ben Vester, K3BC, "C64 WEFAX Improvements," Technical Correspondence, *QST*, Jan 1988, pp 47-49.

[21]Ben Vester, K3BC, "Improved HF Weather Facsimile Programs," Technical Correspondence, *QST*, Sep 1991, pp 40-41.

[22]Ben Vester, K3BC, "Vester SSTV/FAX480/FAX System Upgrades," Technical Correspondence, *QST*, Jun 1994, pp 77-78.

[23]Ben Vester, K3BC, "An Inexpensive SSTV System Continues to Grow," *QST*, Dec 1994, pp 22-24.

[24]Ben Vester, K3BC, "K3BC's SSTV becomes TRUSCAN," Technical Correspondence, *QST*, Jul 1996, pp 66-67.

[25]*LVIEWPRO* Version 1.D is downloadable from **http://www.fis.utoronto.ca/courses/LIS/2108/1995/assign1/lpdown.htm** by clicking on **ftp.std.com/ftp/vendors/mmedia/lview/lviewpro.zip**.

[26]Wiring diagrams for many different brands and models of transceivers are available at **http://prairie.lakes.com/~medcalf/ztx/wire**. These wiring diagrams are helpful in determining if a transceiver's back panel connectors can be used instead of its microphone and speaker connections. Although these diagrams are for connecting transceivers with TNCs, the transceiver's audio connections are the same for clipper interfaces.

Dennis Bodson, W4PWF, retired as Chief of the Technology and Standards Division of the NCS in March. He has been a licensed ham for 42 years, a member of the ARRL for 40 years, and is the current Vice Director of the Roanoke Division. Dennis holds bachelors, masters, and doctoral degrees in electrical engineering, and a masters degree in public administration. He is a Fellow of the IEEE and the Radio Club of America and a licensed Professional Registered Engineer in the District of Columbia and the Commonwealth of Virginia. He also holds radiotelegraph and radiotelephone licenses with radar endorsement. You can contact Dennis at 233 N Columbus St, Arlington, VA 22203; e-mail **w4pwf@arrl.org**.

Steven Karty, N5SK, graduated from Washington University in St Louis, Missouri, with a BSEE in 1968, and is currently a Senior Engineer with the NCS. Steven also holds a radiotelephone license. He and his younger brother, Alec, KØEKP, became Novices in 1960 when they were 14 and 12 years old, respectively. Steven's sons, Aaron, KD4BYW, and Samuel, KD4VRS, became Novices at the ages of 10 and 7, respectively. By contrast, Steven's father, Daniel, NØRDL, didn't become a Novice until he was in his 60s! You can reach Steven at 8709 Southern Pines Ct, Vienna, VA 22182; e-mail **karty@pressroom.com**. QST

New Books

CRYSTAL SET BUILDING AND MORE

Published by The Xtal Set Society, PO Box 3026, St Louis, MO 63130; tel 314-725-1172; fax 314-725-7062; e-mail **xtalset@midnightscience.com**; **http://www.midnightscience.com**. *First edition, 168 pages, 6 × 9 inches, $15.95 plus $2.50 shipping and handling. (Missouri residents add sales tax.)*

Reviewed by Steve Ford, WB8IMY
QST *Managing Editor*

There has been an upsurge of interest in crystal radios during the last few years. Even the simple crystal-receiver projects published in *QST* have been extraordinarily popular. In addition to being just plain fun, crystal radios are particularly powerful teaching tools. (I've yet to meet a student who wasn't delighted at the idea of listening to broadcasts with a radio that appears to run from no power source whatsoever!)

Anyone who has followed this "crystal revolution" is aware of The Xtal Set Society, a St Louis-based organization dedicated to spreading the word about this old, yet fascinating, technology. The Society allows members to share design ideas through its newsletters. For those who are not yet members, or who do not collect the newsletters, the Society has compiled some of the best designs from newsletter volumes 6 and 7 into *Crystal Set Building and More*.

In *Crystal Set Building and More* you'll find projects that are guaranteed to spark your curiosity. One of my favorites is the *FM* crystal receiver. That's right, an FM broadcast receiver! It is a complicated design (for a crystal receiver), but not beyond the ability of a careful builder. Like most people, I've always assumed that crystal-receiver designs worked only with amplitude-modulated signals. You can imagine my surprise when I read this article.

Other curious projects include making crystal-radio headphones from cat food cans (washed and sterilized, I hope!), a simple TRF set, a "double crystal" receiver and a reproduction of a World War II clandestine crystal receiver. Although *Crystal Set Building and More* is primarily devoted to nonpowered radio designs, there is still room for simple "powered" radios. A J-FET shortwave regen by George Trudeau, NU1X, offers good performance from a handful of parts. If you enjoy radios that glow in the dark, try the grid-leak detector one-tube receiver by John Franke, WA4WDL. It's even simpler than the J-FET rig.

Crystal Set Building and More includes the member correspondence that appeared in each newsletter. These comments (similar to *QST*'s "Hints and Kinks" or "Technical Correspondence") are valuable resources. For example, have you ever wondered how to determine wire size? You'll find the answer in *Crystal Set Building and More*. In addition, the entire book is illustrated with detailed drawings along with parts lists and sources. If you're trying to find your way back to "roots radio," *Crystal Set Building and More* is an outstanding guidebook. QST

New Products

HAND-HELD SCANNER FROM SONY HAS PC INTERFACE

◊ Sony's new ICF-SC1PC is a hand-held scanner with a high-tech twist that makes for easy operating and programming: a bi-directional computer interface with search and control capabilities. Features include 300 memory channels; 25 to 1300 MHz coverage (cellular blocked); wide FM, narrow FM and AM modes; multiple computer-controlled scanning functions; and more. The SC1PC comes with a comprehensive frequency guidebook, a CD-ROM frequency database for computerized scanning, an interface cable and all required software

Price: $429.95. For more information, contact Sony Electronics, 1 Sony Dr, Park Ridge, NJ 07656-8003; tel 201-930-1000. QST