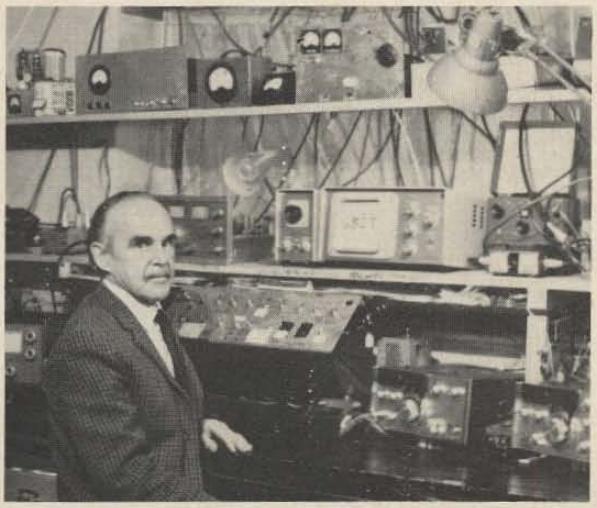
Harold Jones G5ZT
3 Bircham View, Austincres
Egg Buckland, Plymouth
Devon, England

SLOW-SCAN TELEVISION

Slow Scan? What is that, OM?"

Yes, believe it or not, that is the question I am asked time and time again when I have transmitted amateur television Slow Scan pictures on 14230 kHz and announced the fact on SSB, only to find some DL, OK, SM, and even W/K station responding as if I had only transmitted a phone CW call. When I reply that I am ready for Slow Scan transmissions and ask, "Have you that facility?", they appear puzzled:



G5ZT at his station.

"Slow Scan? What is that, OM" When I explain that I have been sending Slow Scan amateur television pictures, they invariably say something like this: "Sorry, OM, I did not know that sound was Slow Scan. I have often heard it but thought it was some commercial RTTY or high speed Morse – I deliberately used the frequency for testing and tuning-up purposes. Television on these DX bands would be most interesting . . . please explain all about it and tell me how I can get equipment going and where I can get the equipment or circuits."

Hence this article to explain in simple terms what SSTV means and what equipment is required. Much has been written about this subject but it seems to me that it has been too technical for many amatuers. They have just given the article a cursory glance and then forgotten all about it.

SSTV is a means whereby amateurs can transmit and receive television pictures world-wide using the normal narrow band wavelengths in the amateur bands of 80, 40, 20, 15 and 10 meters.

All amateurs will understand the principles of commercial broadcast television.

SSTV DX! Transmitted by W4LAS, the picture is of his niece.

This must be transmitted and received on VHF or UHF because of the wide bandwith – anything from 2 MHz to 6 MHz depending on the country. To use a minimum of 2 MHz bandwidth for amateur televison means that hams have to use the 432 MHz or even higher frequency bands, which they do, but activity is comparatively low and communication is normally only a few miles, seldom out of the amateur's own country.

By using SSTV, television pictures can be transmitted using a bandwidth of no more than 2.5 kHz so that transmission is perfectly possible in the 80 to 10 meter bands where world-wide communication is quite normal. Not only is this possible, but, because of the narrow bandwidth used, it easily complies with international regulations, covering no wider a channel than SSB does and even less than that of AM or FM.

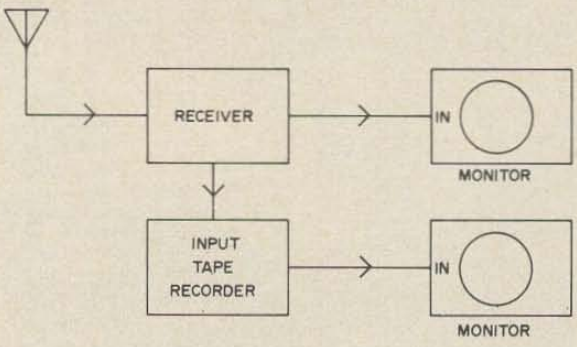


Fig. 1. Block diagram of interconnections for the short-wave viewer and transmitter for television reception.

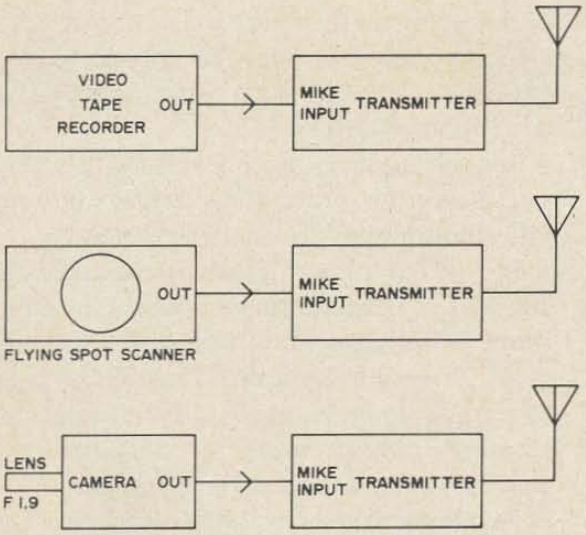


Fig. 2. Block diagram of interconnections for the transmission of pictures.

The difference between amateur television on 432 MHz, where objects can be seen moving, and SSTV, is that the picture must be static. Call signs, photographs of self, yl, xyl, family, shack, cartoons and written messages can be easily transmitted anywhere in the world with surprisingly good definition. But it is fascinating to contact a station 10,000 miles (or even 50 miles) away and exchange a series of pictures.

To make this technically feasible on a world-wide basis, a standard has been reached which all SSTV amateurs use, as follows:

Number of lines	120
Time per frame	8 seconds
Modulation (white)	2300 Hz Modulation FM
Modulation (black)	1500 Hz
Sync.	1200 Hz
Sync duration	
Horizontal	5 milliseconds
Vertical	30 milliseconds

Normally after transmitting video signals, the same frequency is used for sound to announce the fact that you are looking for slow scan contacts. Although technically it is possible to use vision and sound simultaneously on either sideband, I have not heard of this method in use yet. For reception of the pictures, all that is necessary is for the output from your communication receiver speaker terminals to be fed into a cathode ray assembly called the monitor.

The cathode ray tube is the special long-persistence type, usually P-7 phosphor. The incoming signal is truly slow scan and, unlike commercial television which appears to be instantaneous due to the high line and frame rate, appears to *paint* the picture from the top left to the bottom right of the cathode ray tube, taking a total of eight seconds to complete the picture on the tube. That is why you have to use a P-7 phosphor. When this eight second period reaches the bottom of the tube, the sync signal starts the process over again. The normal practice is to transmit each picture for three or more frames, enabling the receiving amateur to get a full picture and tape record. Intensity of the picture is frequency – modulated according to the standards already listed, i.e. for highest brightness, 2300 Hz, for black, 1500 Hz, and for line and frame synchronization by 1200 Hz blacker than black pulses at the line and frame rates. The bandwidth is thus limited to the normal voice grade communication frequencies into the transmitter microphone socket for transmitting and into the receiver circuits for reception.

Now don't think that this is too complex for you. I only commenced operating in this mode on April 22, 1971, and have already had over 80 two-way television contacts with Greece, Sweden, Italy, Alaska, U.S.A., Puerto Rico and Guadeloupe Island. I have received short-wave viewers' reports from Norway, Russia, Czechoslovakia, Singapore, Austria and Australia. This should prove to the doubters what a great deal of activity

Typical logo used by SSTV hams.

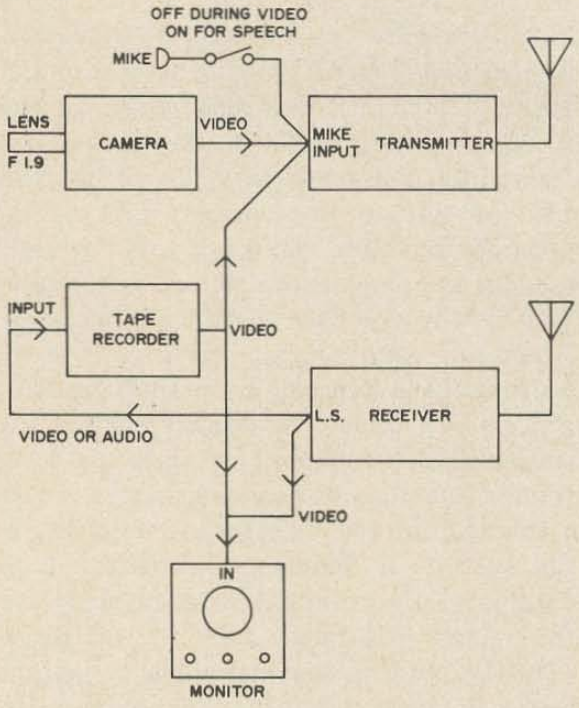


Fig. 3. SSTV interconnections at G5ZT.

there is; it is increasing daily. I understand that there are over 30 countries using SSTV and that some amateurs already have over 20 C. to their credit. I predict that by 1975 the first DX/CC/SSTV certificate will have been issued.

It is a pleasure to find the slow scan amateurs such a friendly bunch, with no rush to get rid of you for the next QSO. Contact for an hour or more is quite normal and the experts are always willing to give you every assistance and advice. The most popular frequencies in use are 3845, 3740, 7050, 14230, 21100, 21430, 28100 and 28600 kHz, the two main long distance frequencies being 14230 and 21430 kHz.

All you have to do is to tune your receiver to the signal which sounds similar to RTTY or high speed Morse with a noticeable "pip" every eight seconds. If you hear the station on sound then that is the correct tuning position to receive the picture.

A tape recorder is almost a "must," since you should tape all signals. Then you can play them back at leisure for checking purposes, proving reception to your friends or taking photographs of the pictures.

For transmitting you can use any of the following methods to feed the picture into your transmitter microphone socket:

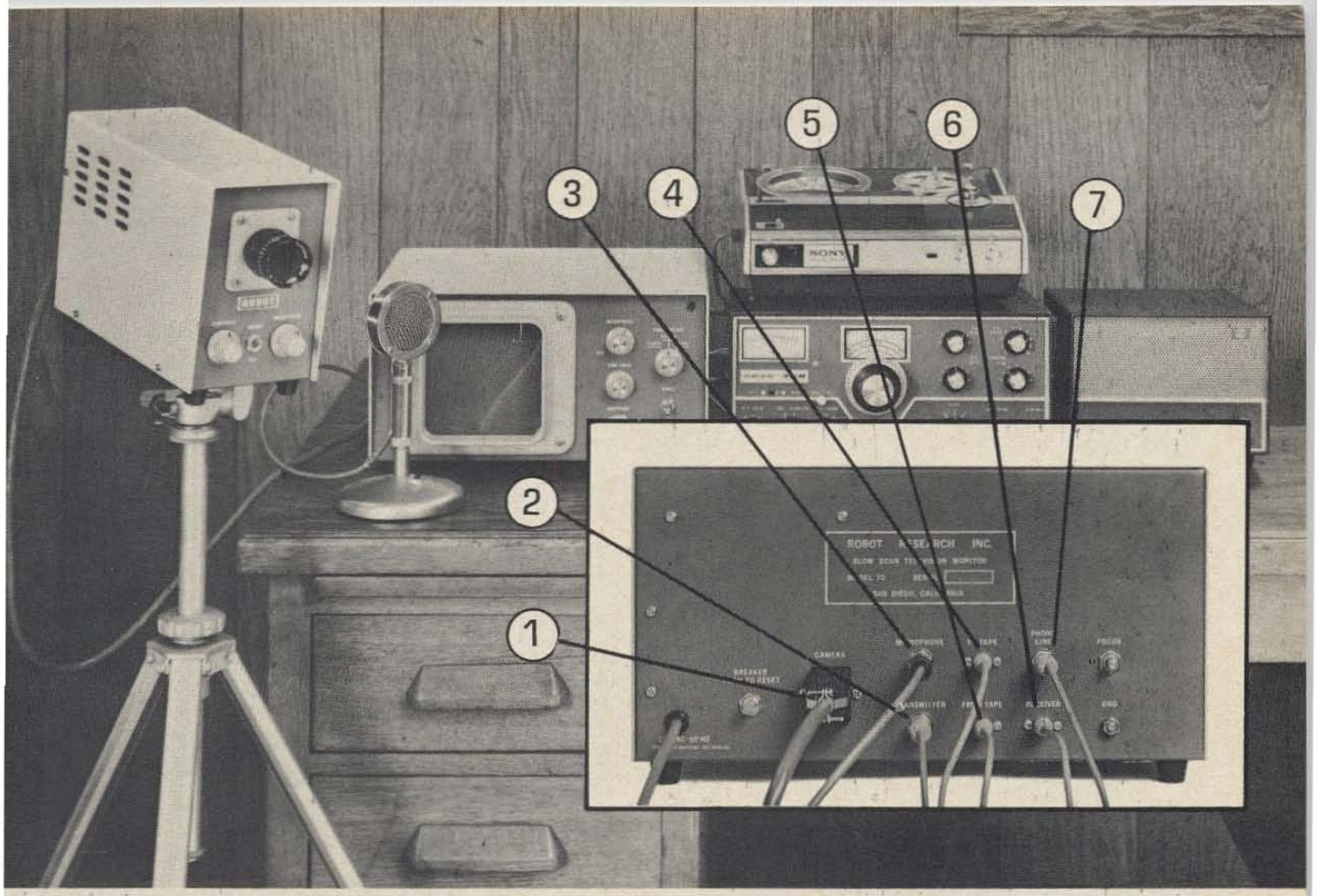
1. Use a video tape recorder. Get an SSTV amateur to make a video tape of your call sign, photographs, etc. All you do is feed recorder output into your transmitter microphone socket.
2. Use a Flying Spot Scanner. With this, you can make up your own version of your call sign to feed into the transmitter.
3. Use a video camera. This is the ultimate for SSTV. You can have a target stand in front of the camera on which to place any writing or photographs or you can turn the camera on yourself, your shack, etc. Camera output again is fed into the transmitter as in the other methods.

The video signal is adjusted to give the same transmitter rf output level as your voice peaks, or just slightly lower, being careful on SSB not to go beyond the specified carrier insertion levels or, if using an AM or FM transmitter, the same levels. If, for example, your SSB transmitter instructions say speech peaks of 150 mA, then I would adjust the video level to around 100 mA.

If you build your own equipment, see the appendix for numerous articles on equipment. If you want to get on the air quickly by purchasing commercial equipment, there are three firms that I know of producing equipment:

Robot Research Inc., 7591 Convoy Court, San Diego CA 92111. Camera and monitor.

The ID picture of FG7XT, as received in England by G5ZT.



Convert your ham station to a complete SSTV station in 7 easy steps:

Just add a Robot monitor and camera and follow these simple instructions:

All popular ham radio sets may be used with the Robot SSTV equipment and absolutely no modification is required. Pictured above is a complete SSTV station. The inset photo shows the back of the Robot monitor, with all connecting cables. To convert your existing amateur station to an SSTV station:

Connect the cable supplied with the Robot Model 80 camera to the socket ① on the back of the Model 70 monitor. Power is then supplied to the camera from the monitor and the video image from your camera is displayed on the monitor.

Next, connect the transmitter connecting cable ② to the microphone jack on your transmitter or transceiver. Your microphone cable now connects to the microphone jack provided on the back of the Robot Monitor ③.

Phono jack ④ connects the signal from your camera or radio receiver to your tape recorder so that it may be recorded for later viewing or transmitting.

Phono jack ⑤ also connects to your tape recorder so SSTV signals previously recorded on audio tape may be displayed on the Robot monitor for viewing, or transmitted, whenever you wish.

SSTV signals coming from any radio receiver or transceiver are relayed to the Robot monitor for viewing and recording by means of cable ⑥ which is connected to the receiver by means of a "Y" connector in the speaker lead.

SSTV signals are connected to the phone line ⑦ to provide two-way SSTV exchange with other Robot SSTV sets connected to the phone line.

After these connections are made, the station is operated by switches on the monitor front panel.

That's all there is to it. As you can see, absolutely no modifications of your existing equipment are required. All necessary cables are included with your Robot monitor and camera.

For a demonstration of Robot SSTV equipment, contact your Robot dealer. Write us for complete information on Robot SSTV equipment, and the name of your nearest dealer.

ROBOT

ROBOT RESEARCH, INC. 7591 CONVOY COURT, SAN DIEGO, CA 92111 (714) 279-9430

This is how SM4AMM must look after receiving TVI complaints.

L.E. Babcock & Company, Inc., P.O. Box 281, Acton MA. SSB transceiver with SSTV add-on units. See 73 magazine May 71.

E.K.Y. Video Vision Co., Box 15, Stockholm NJ. Monitors, monitor kit sets. See 73 magazine April 71.

It will take you no more than one hour after receiving the ready-made equipment to be on the air . . . as simple as that! Reception is remarkably good since even signals as low as S3 will provide a picture and S7 signals will take a lot of QRM punishment. Various simple cabling connections for the viewer and transmitting amateur are shown in Figs. 1 and 2.

The big advantage of taping all contacts is that you can edit the tape, keeping the best pictures and sound reception as a permanent record to photograph at your leisure. I used a standard Philips tape recorder which cost me $10 secondhand, and I bought an ordinary camera for $20. Having set up the camera for correct aperture and focal length, give the film an eight second time exposure when the picture on the monitor starts at the top. It will take eight seconds to reach the bottom. The photographs in this article were taken by this method. Times for long distance communication will be the same as for phone contacts mainly operating on 14230 kHz or 21430 kHz. It is just a question of being on the air at the right time to catch the DX – often 0300 GMT for me!

. . .G5ZT

Appendix.

Macdonald, C. "A New Narrow-Band Image Transmission System," *QST* August and September, 1958.

Macdonald, C. "Slow-Scan Image Transmission, A Progress Report," *QST* April, 1960.

Macdonald, C., "S.C.F.M. An improved system for Slow-Scan Image Transmission," *QST* January and February 1961.

Plowman, J.A., "Slow-Scan Picture Transmitter," *The British Amateur Television Club*, London, 1961 (out of print).

Macdonald, C., "A Compact Slow-Scan TV Monitor," *QST* March, 1964.

Macdonald, C., "A Slow-Scan Vidicon Camera," *QST* June, July and August, 1965.

Macdonald, C., "Twenty-Meter Slow-Scan Tests," *QST* September, 1966.

Simpson, R., "Narrow-Band TV Using Pseudo-Random Dot Scan," in Technical Correspondence, *QST* January, 1967.

Sulu, G.V. (Editor), Amateur Television Issue, *SIRAN* Journal of the Bangalore Amateur Radio Club (South India Radio Amateurs Newsreel), March, 1967.

Cohen, T.J., "An Economical Slow-Scan Television Monitor," *73* July, 1967.

Hutton, L.I., "A Slow-Scan Television Picture Generator," *73* October 1967.

Anon., FCC Proposal on Slow-Scan TV, *QST* November, 1967.

Anon., ARRL Comments on FCC Proposal on Slow-Scan TV, *QST* February, 1968.

Anon., F CC Approval of Slow-Scan TV Docket, *QST* September, 1968.

Taggart, R.E., "Slow-Scan with Regular Vidicons," in Technical Correspondence, *QST* December, 1968.

Hutton, L.I., "A Fast-Scan Vidicon in the Slow-Scan TV Camera," *73* February 1969.

Watson, D.J. and Horne, S.M.K., "New Solid-State Camera and Monitor for Slow-Scan Televison, *Ham Radio* April, 1969.

Popkin-Clurman, J.R., "A Simple Inexpensive FM to AM Converter for Slow-Scan TV and Facsimile,' *73* June, 1969.

Hutton, L.I., "A Slow-Scan Television Signal Generator," *73* July, 1967.

Miller, D.C., "Slow-Scan Television" *CQ* July and August, 1969.

Taggart, R.E., "A Procedure for the Reception of Slow-Scan Color Pictures Using Additive Synthesis," *73* November, 1969.

Backman, A., "SSTV" *73* December, 1969.

Taggart, R.E., "Slow-Scan Television," *Ham Radio* December, 1969.

Cohen, T.J., Harmon, D., and Veazey, D., "Sampling Techniques," in, Taggart, R.E., "Slow-Scan Television," *Ham Radio* December, 1969.

Backman, A., "Slow-Scan Television, Radio Communication"*(R.S.G.B.)* February, 1971