NARROW-BAND VIDEO: THE UPI "NEWSTIME" TECHNOLOGY

Glen Southworth
Colorado Video, Inc.
Box 928
Boulder, Colorado 80306

July 3, 1978, marked the beginning of a new era in visual communications. On that date United Press, International, inaugurated "NEWSTIME" programming which combined audio and slow scan television to provide a unique new information service to cable TV systems throughout the United States. In NEWSTIME, UPI effectively combined the elements of still images from wirephoto and slide sources, audio from remote feeds and studio production, plus information from many sources to produce a basic 15-minute news show, transmitted 24 hours a day, with frequent updates.

The use of slow scan television is a key factor in providing economical transmission of the video portion of NEWSTIME. A bandwidth of only 8 kiloHertz allows a picture update time of 8½ seconds, with the viewer seeing a horizontal "wipe" when a new image is transmitted. Eight kiloHertz channels are not too common in the case of terrestrial communications, and consequently satellite transmission via RCA Satcom was chosen for signal distribution. Slow scan video and audio are "piggy-backed" above the baseband video signal of Super Station WTCG in Atlanta by means of two low-amplitude subcarriers at 6.2 megaHertz for video and 7.4 megaHertz for audio.

Figure 1. UPI NEWSTIME PRODUCTION FACILITIES AT DOUGLASVILLE, GEORGIA

The NEWSTIME program starts out with "real time" video, is scan-converted to narrow-band TV for transmission, and then reconverted to EIA standards for normal distribution throughout the cable system. This approach provides a great deal of program production flexibility using readily available, conventional hardware. Three-quarter-inch, U-Matic video cassette recorders were chosen as the most convenient method of assembly, editing, and playback of the combined audio-video program. Audio is reproduced normally, while the video portion of the tape playback is fed to a sampling type of scan converter which produces a high quality slow-scan TV signal.

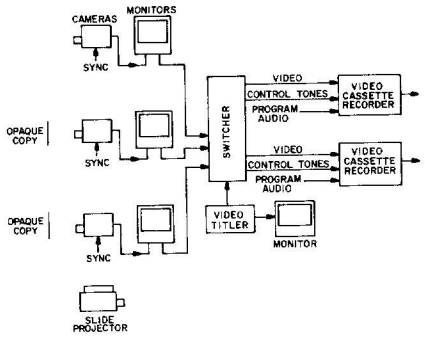

Figure 2. BLOCK DIAGRAM OF UPI PRODUCTION EQUIPMENT

The scan conversion process involves taking one narrow sample from each line of the active TV raster, starting at the upper left hand corner of the picture and generating a vertical column or visual "slit". Each of these samples (less than 100 nanoseconds wide) is then "stretched" out to approximately 64 microseconds, thus filling in the gaps. On succeeding TV fields, the sample row is slowly moved from left to right to convert the entire image. The field rate of the original video signal now becomes the line rate of the slow scan TV signal, and the scanning format is rotated 90 degrees. Line sync pulses are added to the slow scan video in a fairly conventional manner, except that two separate widths of sync pulses are used in order to identify the field from which the original sampled information came. A short 400 Hertz tone also precedes the start of each new image in order to initiate the picture reconversion process at the receiving station scan converter. A more comprehensive description of the slow scan signal format is listed in table one, but it is important to note one other special characteristic, that of "dot-interlace", which results in a subjectively superior picture with reduced number of picture elements, an important

consideration in terms of faster transmission times and in the lowering of memory size requirements at the receiver.

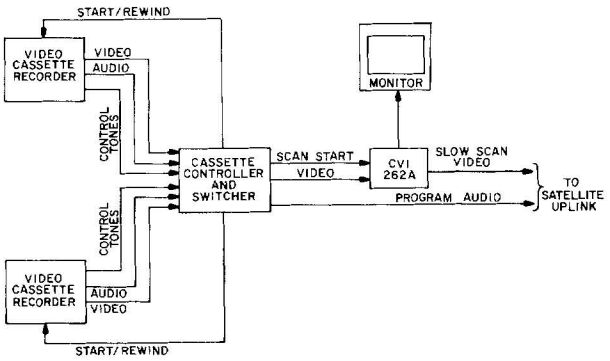

Figure 3. BLOCK DIAGRAM OF UPI SCAN CONVERSION SYSTEM

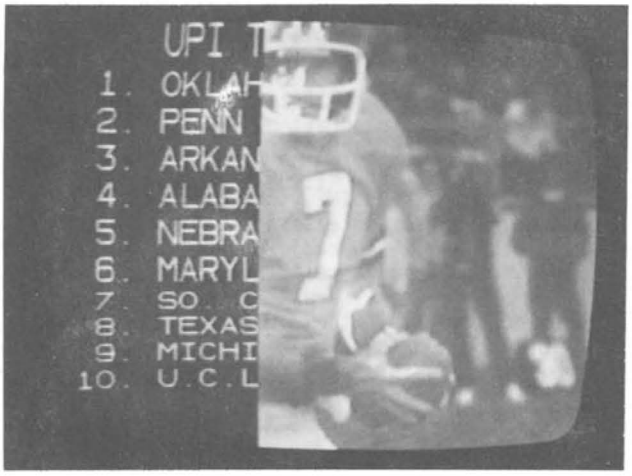

Figure 4. OFF-SCREEN PICTURE OF RECONSTRUCTED SLOW SCAN TV SIGNAL MID-WIPE

The sampling scan converter is a relatively simple device which produces high quality output signals. It does, however, require that the video signal fed into it be "stationary" for the length of time required for the conversion process. This condition is easily met by continuously recording an image for 9 seconds on the video cassette tape, and using a short tone burst on the second tape audio channel to start the sampling procedure.

The present NEWSTIME system reproduces monochrome pictures only, but provision has been made for later addition of color. The first step in this direction will probably be the incorporation of colored titles, borders, or simple graphics. It is also feasible to generate full color images with slow scan TV technology, but program production factors and other considerations make the introduction of this form of transmission somewhat further downstream.

The receiving part of the NEWSTIME system uses a standard earth station with a two-channel subcarrier demodulator recovering audio and slow scan signals. Again, the audio portion is used directly, but the slow scan video is fed to a scan converter which reconstructs the original pictures in conventional EIA format for subsequent distribution over the cable system. The receiving converter is actually more complex than the one used at the transmitter because of the need to incorporate a memory capable of storing a complete image. Solid state computer technology is used for this purpose, and the memory is organized as 256 x 256 picture elements per field with 6 bits per element for grayscale, giving a capability of 64 shades of gray. The dot-interlace format used means that picture elements are "staggered" horizontally on a field-to-field basis, giving greatly improved subjective horizontal resolution. An EIA test pattern reproduction will appear to have nearly normal vertical resolution and approximately 270 lines on the lateral axis.

An internal sync generator with gen-lock capability provides timing for the receiving scan converter. The gen-lock allows additional operational flexibility for the cable operator in terms of local titling or signal mixing. The sync generator also produces a 3.58 megaHertz subcarrier signal for use with external "colorizing" circuits.

NEWSTIME has opened up some important opportunities in providing a variety of economical special services. The relatively small video bandwidths used means that many channels could be added to existing and proposed satellite transponders. In fact, if a single transponder were devoted to transmissions of this nature, it could handle approximately 100 simultaneous slow scan plus audio programs. News, information, instruction, and teleconferencing applications are all adaptable to the slow scan format. Not only is transmission much more economical than "real time" TV, but program production may be greatly simplified, even down to a one-person operation.

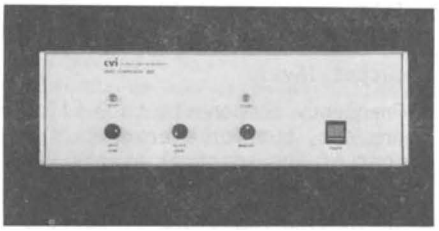

Figure 5. COLORADO VIDEO MODEL 262A VIDEO COMPRESSOR

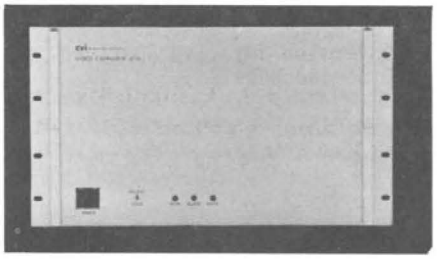

Figure 6. COLORADO VIDEO MODEL 275 VIDEO EXPANDER

On the local level, slow scan TV can mean special services that would be completely impractical otherwise. Literally hundreds of narrow band video signals can be "stuffed in the cracks" of the cable system to interconnect schools, fire departments, police stations, hospitals, and other institutions with visual communications. Even when the final pictures end up on a broadband channel, as in NEWSTIME, the relatively low production costs and ease of multi-point program origination, via the cable or dedicated telephone lines, can provide some attractive opportunities.

The present thrust of technology appears to be definitely in the direction of improved performance and lower costs of slow scan TV hardware. The possibilities seem well worth investigating by the cable industry.

Table One
UPI NEWSTIME SLOW SCAN TV SIGNAL FORMAT

Line: Scans perpendicularly, top to bottom, at a rate of 60 lines/second. Line is composed of sampled data with the number of elements being equivalent to the number of lines in one field of the input signal. Line blanking interval is the same as the field blanking of the input signal. Adjacent slow scan lines will be "dot-interlaced" due to the 2:1 interlace characteristics of the input signal. Resolution is essentially the same as the vertical resolution of the input signal.

Line sync is 0 to -2 volts, .5 ms or 1 ms duration depending on field sampled.

Frame: A 400 Hertz "start burst" precedes the initiation of the frame which scans horizontally from left to right at a rate of 8.53 seconds per picture. Horizontal conversion linearity is 1% or better.

Video: -DC coupled, white postiive, 0 to 4 volt output level.

-Frequency components to 8 kiloHertz may be present, but for average pictorial material most of the spectral energy will occur at 60 Hertz and harmonics thereof.

-Conversion Amplitude Linearity: less than 3% distortion.

-Conversion Signal to Noise Ratio: 40 db unweighted.

-Conversion Sampling Aperture: nominally 50 nanoseconds.

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