A New Edit Room Using One-Inch Continuous-Field Helical VTRs

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A new on-line videotape edit facility at CBS Television City in Hollywood incorporates some unique features. The system was the first to utilize the new broadcast-quality one-inch helical videotape recorders. This computer-controlled edit facility employs custom VTR remote control panels at the operator's console to provide the editor with full control of the low- and high-speed search of these VTRs. The system also employs Vertically Encoded SMPTE Time Code, or VEST, to achieve frame identification in the still-frame mode. The paper discusses major design and operating features of this unique system.

Introduction

The editing facility described in this paper is located at CBS Television City in Hollywood. The facility is the first editing room to utilize the new 1-in broadcast-quality helical-scan videotape machines which offer so many advantages over quadruplex machines for post-production editing.

Especially attractive is their ability to move tape in either forward or reverse direction, at speeds varying from still frame to very fast, while providing a color picture at 8 times the play speed and a monochrome picture up to 40 times the play speed. Beside these features, our requirements called for small reliable machines which could be placed in an equipment room near the edit room. Based on these considerations, CBS chose four Sony BVH-1000's and installed them as shown in Fig. 1.

Because the audio and video quality of 1-in broadcast helical-scan machines is equal to or better than that of quadruplex, the edit system can be used either as an on-line facility, to produce the edited master directly, or as an off-line facility to produce a work copy, with the originals to be conformed later using an assembly system.

The CMX System 340X editor used in the edit room requires only a shielded, twisted pair of wires between the computer and each recorder, simplifying control patching requirements. The flexibility provided by microprocessor-based interfaces makes modifications easier. Also, the CMX System 340X and System 300 decision list formats are compatible, allowing output of any of the earlier Television City edit systems to be assembled or re-edited on any other, assuming the recorded material is available on the proper format.

The advantages of the 1-in broadcast-quality helical VTRs, such as forward and reverse motion at varying speeds, and an identifiable freeze frame, make it easier for the operator to select edit points than with quadruplex machines. To take full advantage of these capabilities, however, two significant improvements had to be added by CBS, namely, a new three-part control panel with human-engineered features and a means of recovering time code from a still frame.

A Human-Engineered Control Panel

Creative people, we have found, do not like equipment in which related control functions are distributed among many different pushbuttons. Thus, the single knob that provides both the high-speed shuttle function and the low-speed jog function on the Sony VTR was desirable in terms of speed and convenience, while the absence of such a control on the standard CMX keyboard was undesirable. To give free rein to the editors' creativity, an optimally designed control panel was needed.

CBS therefore decided to design its own control panel, incorporating many changes. The resulting human-engineered control panel is shown in Fig. 2. It consists of three parts: the alphanumeric keyboard, the joystick control knobs, and the main control panel. They are arranged with the most often used controls nearest to the operator.

The top (alphanumeric) keyboard is similar to a teletypewriter keyboard and thus to a standard CMX control keyboard; for this application it is used only for the initialization procedure, for adding notes, and as backup for the main control panel.

The joystick control knobs, one for each of the four recorders with space for a fifth to be added in the future, are in the center portion. They provide the same shuttle and jog functions as the local control knob.

Because each machine had a CMX Intelligent Interface (I^2), it was decided that the interface should always remain connected to the recorder remote-control receptacle. The remote joystick commands enter the I^2 via a CBS-designed interface board and are transmitted to the recorder's remote-control entry.

In attempting to implement this, however, one problem required a solution. How was the I^2 to "know" when to take instructions from the main computer and when from the remote joystick? After much study, it was decided that the joystick would always have control unless the operator had, by means of the main control panel, asked the system to embark on an automatic routine such as cue, preview, or record. Once the command for an automatic routine is received, the I^2, using redesigned firmware logic, no longer sees commands coming from the joysticks of whichever machines are involved in the routine. (It should be emphasized that all other machines not involved in the routine retain joystick control, so the operator can start these machines shuttling to the location of the next scene to be edited simultaneously with the automatic routine.) After the computer-controlled function is complete, control is returned to the manual joystick. In order that the operator may be kept informed as to the status of the joystick, each knob has a red light which is switched on as a reminder when the computer has taken control away.

For operator convenience, play and stop functions were provided in addition to shuttle and jog. This way, the operator can select edit points without moving his or her hands from the joystick area.

The third portion of the control panel, designated the main control panel, is the section nearest the operator. It contains buttons for VTR selection and control, list management, system mode, edit-point selection and type, and a 10-button numerical keyboard for entering data. After initialization, the operator works between this panel and the joystick control knobs to edit a program.

The main control panel is color-keyed and divided into functional areas. It is arranged to provide additional convenience and speed for the operator. The colors help identify a control group quickly. Because of the logical and more open arrangement, operator errors have been reduced. In order to minimize system modifications, each function button on the main control panel which had a corresponding button on the CMX-style keyboard is designed to provide the same ASCII code as before. The controls which the top alphanumeric keyboard have in common with the lower main control panel are in parallel, and either may command the system. This is the backup feature referred to earlier.

The main control panel itself is constructed of a series of small building blocks stacked in columns and rows in the required arrangement. This modular concept allows complete flexibility in the present configuration and simplifies future changes as well. Pressing any particular button causes the interruption of a series of infrared light beams to provide a pattern that is unique for that button. This information is fed into a microprocessor which is programmed to output the required ASCII character for each command.

Finally, CBS selected a 14-in monochrome picture monitor for the character-generator display. The monitor is

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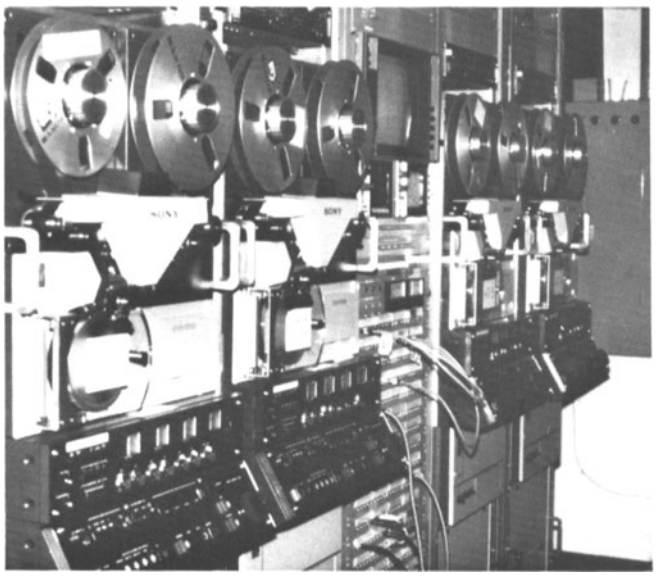

Fig. 1. Four Sony BVH-1000's with ancillary equipment, installed with shared monitoring.

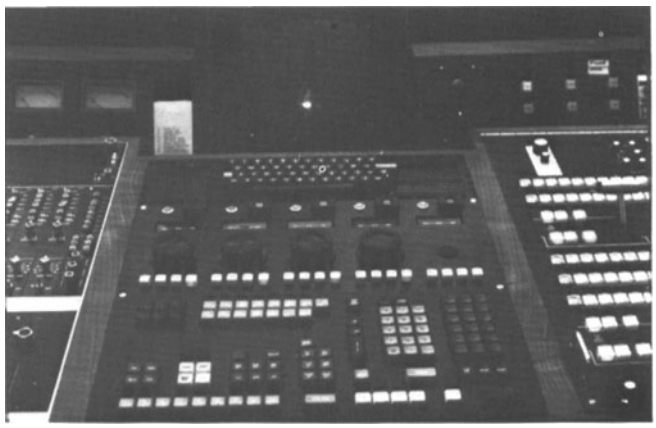

Fig. 2. Three-part control panel. (Top) alphanumeric keyboard; (Middle) joystick control knobs; (Bottom) main control panel.

mounted on a sliding-track arrangement and can be adjusted either forward or backward, to suit each operator.

VEST (Video Encoded SMPTE Time Code)

The second CBS improvement added to the system in order to take full advantage of the 1-in helical-scan VTRs was Video Encoded SMPTE Time Code, which CBS calls VEST. For this application, the time is encoded in the vertical interval. It will be recalled that the SMPTE time code was designed to be recoverable from a longitudinal track at speeds as slow as one-fifth to one-tenth play speed. This has been satisfactory for most quadruplex on-line editing systems up to now because quadruplex VTRs do not provide slow motion or freeze modes.

Off-line systems employing helical-scan VTRs have had code-recovery problems at low speed, and, in some cases, the operator was not free to run the tape as slowly as required for easy and accurate editing. One solution would have been to put the time code in the video by means of a character generator. The operator then would know exactly what frame he had chosen, but would have to manually enter the time code address corresponding to that frame.

Because the system developed for CBS Television City was to be an on-line as well as an off-line system and because the manual entry of time code is very slow, it was agreed that time code characters displayed in video were not practical. Thus, the decision was made to use vertical-interval time code to provide a "true tally" readout from each frame.

The VEST equipment chosen was the Sony BVG-1000, shown in Fig. 3. It solved the problem of recovering time code from a still frame. This device functions as a combined serial time code generator, VEST encoder, serial time code reader, VEST decoder, and character generator. The identical code is inserted in lines 12, 13, and 14, for redundancy. When using VEST, the serial time code is always clocked out at 80 bits/frame, regardless of the speed or direction of the VTR. Because the CMX software "expects" to see time code entering the I^2 at different rates according to the speed of the VTRs, certain software changes were necessary. (A detailed discussion is beyond the scope of this paper.)

It should be noted that VEST, in the form supplied by the BVG-1000, cannot be recovered at high speeds. The unit takes this into account and automatically switches the reader between VEST and longitudinal time code at one-fourth play speed. CBS utilizes this selector and brings out a tally from it to inform the software as to the source of the code.

To provide additional speed in editing, the software was modified to allow the mark-in and mark-out functions (which the operator uses to select most edit points) to be active in play, slow motion, and freeze.

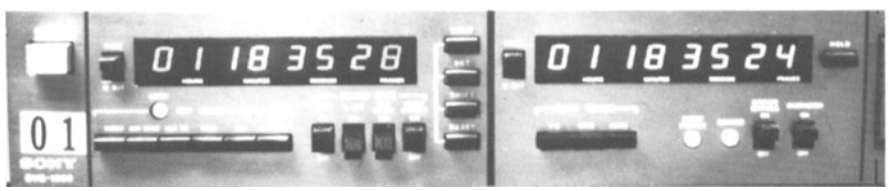

Fig. 3. Sony BVG-1000 vertical-interval time code unit for the VEST code. (One such unit is installed with each VTR.)

Fig. 4. View of stations in the edit room, showing color monitors and speakers in the background. In the foreground, left to right, are: audio switcher buttons; audio console and meters; control panel and monochrome display monitor; video switcher panel and picture monitor assignment panel.

A number of factors have required changes in the software and firmware of the system. Four such factors and the subsequent modifications are as follows:

1. The use of VEST required changes to recognize and use the switch tally which indicates whether the system is receiving VEST or longitudinal time code. Since the VEST time code rate from the decoder is 80 bits/frame even in slow motion or freeze, software modifications were necessary so this constant-rate code would be acceptable.

2. The new main control panel required changes to accommodate the additional control buttons.

3. The remote joystick control knobs required software changes to handle the assignments and convert the joystick commands to be used by the I^2.

4. The joystick on/off logic control required changes to automatically select between computer control and joystick control.

The edit room audio/video facilities are shown in Fig. 4. Audio and video monitoring is typical of CBS edit rooms. Four broadcast-quality color picture monitors and two full-range audio monitoring systems are provided.

The video switcher is standard, with two mix/effects units. The computer "talks" only to one mix/effects unit, but various combinations of computer and manual control of the different portions of the switcher are possible, depending on the settings of three local/remote switches.

The audio switcher crosspoints can also be operator- or computer-controlled. All tape recorder outputs appear as inputs to both the audio switcher crosspoints and the audio console. The audio switcher output re-enters one input of the audio console, providing the ability to mix VTRs or wild sources with the computer-controlled output of the audio switcher.

Summary

In summary, the design of the newest edit system at Television City has been described. The salient features are as follows:

1. The system can operate either on-line or off-line.

2. It uses 1-in helical-scan VTRs, providing very fast shuttle with viewable pictures, slow motion in either direction, and freeze-frame.

3. It features vertical-interval time code for accurate recovery of the code at slow speeds or freeze frame.

4. It has remote joystick control knobs.

5. The system enables mark-in and mark-out functions when the joystick control knobs (as well as the usual controls) are used and VEST is present.

6. It provides the editor with a three-part control panel with special features for added speed and convenience.

7. Finally, it allows interchange of edit decision lists between this system and the earlier systems at Television City, for re-editing or assembly.

The system was first used as an off-line facility in August 1977, and in the on-line mode in November. It has been regularly employed for a number of television programs and specials since then.

Predicting the future is difficult, but this edit facility is designed to accommodate the addition of more VTRs, more monitors, more audio/video features (such as a digital special effects unit) and more control functions. Television post-production techniques can only become more sophisticated as time goes on. The system described has sufficient flexibility that it can be easily adapted to meet future needs as they are recognized.