

# TECH NEWS

## Videotape Editing and Program Assembly

no. 8 in a series of 10

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When the Ampex video recording system was announced in 1956, almost at once users began insisting on the need for editing facilities. At the time, the best suggestion Ampex engineers could offer was to cut the videotapes with a razor blade and join the two ends together with a piece of sticky tape. But it was not long before much more sophisticated splicing and editing methods were devised.

A Canadian, Norman Bounsall, who went from the National Film Board in Montreal to work at the Ampex Corp. in the United States, was responsible for a major advance — electronic editing — described in the February 1962 issue of SMPTE Journal.

Electronic editing enables portions of recorded programs (scenes) to be dubbed (electronically transferred) to a program master tape leaving the original recordings intact. No cutting or splicing is involved in electronic editing. The video and audio tracks on the tape being used for assembling a program (the master tape) can be erased automatically in exactly the proper locations in an already transferred scene, so that new video and audio tracks (for the next scene) can be laid down on the tape, giving the effect of a straight cut between the two scenes.

To make a splice between two scenes, two recorders are needed, one in the playback and the other in the record mode. The original recording, which may be from a live television camera or from film transferred in telecine, is placed on the playback machine, while a blank videotape is placed on the record machine to become the master program tape. At

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the start, a portion of the original recording containing the first scene is dubbed onto the master tape. The next scene is then located in the original recordings and cued up on the playback machine. (In the early days of electronic editing the practice was adopted of putting cue marks on the tapes with a felt pen to indicate the splice point between scenes.) The two machines are then started, both in the playback mode, and at the point indicated by the cue marks, the machine carrying the master tape is switched by the operator to the record mode. Sophisticated solid state electronic circuitry takes over to make the splice at the next following frame synchronizing pulse.

### Programmed Editing with Frame Accuracy

Electronic editing opened up a whole new world of program production possibilities on videotape. But even with this important development the editing process was still a painstaking and time-consuming operation, in no way comparable with film editing methods. A basic difficulty with videotape is that the recorded pictures can be made visible on a television picture monitor only with the playback machine running at precisely the right speed (locked to television synchronizing pulses).

While electronic editing considerably enhanced program production on videotape, production people and videotape operators soon began to realize its limitations. Its greatest weakness was the dependence on the operator's reaction time and manual dexterity. Finding just the right places in the action to make a "splice" between two scenes required running the machines back and forth over the same parts of the scenes several times. Then, in making the edit, it was only by good luck that the splice between the two scenes occurred in just the right part of the action, dependent on the operator depressing the record button at exactly the right instant.

The next step was the development of programmed editing with frame accuracy. This was accomplished automatically by means of tone bursts recorded in the cue track of the videotape. This development offered the very great advantage that an edit could be previewed (simulated) — and if necessary adjusted — before actually making the edit on the master program tape.

With this method of program assembly tone bursts are recorded in the cue track at the points where edits are to take place, determined as before by playing back the tapes several times to find just the right points in the action. Then, instead of putting cue marks on the tapes, tone bursts are recorded by pressing a button. In the preview mode, the tone bursts automatically switch the machine outputs to the television picture monitor only, to show where the edit takes place. If the result is not acceptable, the tone bursts in the cue track can be advanced or retarded by any desired number of video frames to obtain just the right effect. Then the edit can be made on the master tape by switching the machine from "preview" to "edit" mode.

### SMPTE Time and Control Code

This development greatly eased the task of the operator in making edits and seemed at the time to be the last word in sophisticated videotape editing. But there was still the problem of locating a particular scene in the original recordings, a task that took up an inordinate amount of time during videotape editing sessions. Until the introduction of random access editing in the late 1960's, production people could only give the machine operator the approximate location of a wanted scene in a recording, usually by elapsed videotape running time. Only after a scene had been located and verified could the editing points be selected.

Several companies, including Advertel in Toronto and Central Dynamics in Montreal, developed systems of time coding

videotape to identify recorded scenes, and to enable the playback machine to automatically locate the start of any scene in a recording by the corresponding time code. The "address" in the SMPTE time and control code, eventually adopted and made official in American National Standard C98.12-1975, consists of binary code groups recorded in the cue track, identifying each frame by a unique number. The code numbers can be displayed on an electronic counter, and used to identify scenes as the time recordings are being made, and also to provide instructions for the machine operator during videotape editing. These numbers can also be used to "instruct" the videotape machine to locate a scene in the recordings and cue up the first frame of the scene on a picture monitor, by simply punching the corresponding numbered buttons on a keyboard.

### **Electronic Post-Production Systems**

In spite of these really astonishing developments, videotape editing was still being hampered by the inflexibility and high costs of available systems, and especially the amount of time needed to make editing decisions, while simultaneously tying up scarce and very costly professional broadcasting facilities. Among the many proposals made to overcome these obstacles was a system developed by CBS Television Network jointly with CMX Systems in California.

In the CMX electronic production system all the original program recordings, along with the SMPTE time and control code in the cue tracks, were transferred to video discs, mounted in packs with a recording capacity of about 5 minutes, 12 disc packs for one hour. To begin an editing session all the scenes identified by their time and control codes were stored as an edit list (menu) in a computer. The editor could call up any scene with a "light pen" applied to the appropriate item in the edit list appearing on the face of a television picture monitor. Then, from a display of code blocks indicating the various machine functions, any desired operation could be initiated with the light pen.

When the decision-making process in the editing of a program was completed, the computer printed out on a magnetic cassette all of the decisions made by the editor. This cassette was then used to automatically assemble the program on a master program tape, taking video and audio from the original recordings. In this process up to six 2-in. quadruplex recorders could be used, one in the record mode (the master program tape) and the other five playing back portions of the original recordings as called for by the computer.

This early development has survived at the CMX 600 editing systems. Other models, including CMX 300 and 50, are also available, as well as similar systems from a number of other manufacturers.

### **On-Line and Off-Line Editing Methods**

During the past two or three years the microprocessor has become the key building block in videotape editing systems, and the application of the computer to videotape editing has vastly enhanced the flexibility of videotape post-production.

Two methods of editing are commonly used today. The on-line method consists of editing the original videotape recordings to obtain the master program tape. In professional program production all of this work is usually carried out on 2-in. quadruplex videotape recording machines. Off-line editing techniques have been developed to enable time-consuming editing decisions to be made on another lower cost videotape medium — usually 3/4-in. video cassettes.

On-line editing is the most convenient method in many of the simpler, less time-consuming decision-making situations. Programs are built up scene-by-scene, by dubbing (transferring) portions of the original recordings on one machine to the master program tape on the other machine, utilizing, as a rule, programmed editing facilities as already described. One troublesome problem with this editing method is coming out at the end with a program exactly the right length to fit into a scheduled television time period. Sometimes there may be no alternative but to physically cut and splice the master tape to take out part of a scene.

With the off-line editing method problems of this kind should not occur since programs are built up scene-by-scene from edit lists prepared from the time codes recorded on the videotapes. At some stage before editing commences, time-coded 3/4-in. cassette copies are made from the 2-in. original recordings, with the time code

readout (recognizable numbers) superimposed in the pictures. These 3/4-in. video cassettes are then taken away by the production group to prepare the edited programs.

As the video cassettes are being reviewed in less costly helical scan machines, an edited program structure begins to take shape, and the edit list is prepared by noting down on a sheet of paper selected scene descriptions, reel numbers and the time code numbers at the beginning and end of each selected scene. Sometimes a video "workprint" is made by assembling scenes on another 3/4-in. video cassette in accordance with the edit list, for final viewing and approval before work starts on the assembly of the 2-in. quadruplex master program tape.

With some computer-assisted editing systems, the editing decisions are punched as code blocks into a paper tape; with other types of equipment the editing decisions are recorded on a floppy disc, a magnetically coated flexible disc about the size of a 45 rpm. audio record, with a capacity to store up to 3000 edits on each side. Upon completion of the cassette editing, auto-assembly of the 2-in. program master tape can begin, controlled by the coded information in the punched paper tape or floppy disc.

Writing in the August 1977 issue of SMPTE Journal, Arthur Schneider, an experienced videotape editor, describes what he calls "Edit List Management," the techniques of edit list preparation "understandable" to the computer. Summing up, he complains that it should not be necessary to go through a series of complicated keyboard steps just to make a simple edit. Some computer-assisted editing systems tend to make the editor feel in need of an engineering degree, but some new models now provide keyboards with all the editorial functions identified by individual keys. Also, systems are being developed to "clean up" edit lists, detecting and correcting errors before auto-assembly commences.

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