

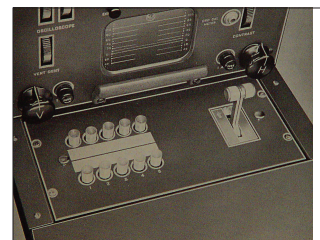
# Switching the Video

## Humble Beginnings

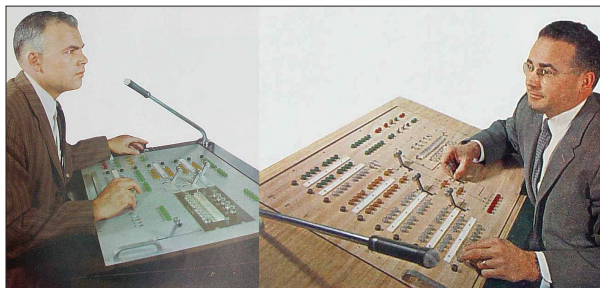
We've looked at the effort behind generating the audio portion of the program and have discussed the tools the audio people use to create the mix. We have also talked about the person who turns the director's commands into the video stream, namely the technical director. In this section we're going to look at the two main tools that the TD uses to perform the video magic we see on-air. The TD has two main control panels in front of him — one for the video switcher and the other for the DVE/DME.

The switcher is the video equivalent of the audio mixer; in fact the Europeans, especially the British, like to refer to video switchers as vision mixers. In essence the switcher is the device that selects which source or sources are on-air at any given time. A switcher's simplest operation is to "switch" from one source to another. We'll look at how the process of switching between sources can grow to involve hundreds of buttons and knobs on a control panel.

The other device the TD uses to meld the sources at his disposal into a cavalcade of visual images is the DVE/DME. This is what allows for multiple sources to be used, such as multiple full-frame cameras on-air at once, or video transitions that look like pages turn, or pictures that change size and fly off the screen, or camera shots that are rolled up and look like they're wrapped around globes or cans, etc. In fact the effects that these devices can do today are often limited chiefly by the human imagination. The first DVE was the grandchild of the VTR's time base corrector (TBC). TBCs use computer memory to store incoming video off tape, which was not at a constant pace because of the mechanical nature of the VTR, and march that video



**Figure 6.32** Most things have humble beginnings; the video switcher started as a simple device. The two simple activities of this early switcher are still the basis for almost all switcher operation to this day. This switcher could switch and fade or dissolve between five sources, hence the five buttons in each row. A dissolve is a mix of two different sources used most often as a transition between one source and the next. It often signifies a change in scenes. The fader bar to the right allowed dissolves between two sources. The bank of switches that was actually on-air is the one that the fader bar was pointed toward. To fade or dissolve to another source, the new source was selected on the opposite bank and the fader bar handle was push/pulled to that bank of switches. Like all early audio mixers, and many still used today, the control panel and the electronics for performing the actual switches and dissolves were in one box.



**Figure 6.33** Switchers grew up fast, and started their march towards sophistication and complexity. More sources needed to be switched and more involved scene composition was being used. Both these photos show control panels for RCA's TS-40 production switcher. The TS-40 was the first switcher to separate the operator's control panel from the electronics that actually did the switching and dissolving. These photos, actually of truck switchers with their backdrops eliminated, also show that different control panel layouts could be ordered to control the same switcher. The concept of the effects bank was introduced. Each paired bank of switches grouped with a fader bar was an effects bank. On the photos you might make out the cascading flow of effect banks flowing to additional fader bars that are "downstream," which provide the final video output.

back out of memory at a constant rate. After the TBC, the frame synchronizer fell out next, as memory size and price both dropped. The frame sync allows sources not locked to the other sources in the truck, such as a stand-alone RF camera or a blimp camera, to be put into sync with the truck's reference. From there, engineers discovered that if you manipulated the video stored in the frame sync's memory, you could produce simple but interesting effects. When the computer or embedded microprocessor became ubiquitous, these simple efforts became flamboyant.

It's Not so Simple Anymore



into the program bank closest to the TD. The fancy technical term for this is fixed "re-entry" (Source: Tim Stoffel)

Figure 6.34 By the 1970s, video switcher control panels looked much like they do today. This GVG-1600 switcher was a mainstay on trucks throughout the '80s. This particular switcher has a main program bank and two effects banks, each one associated with a fader bar. The fader bar was used either to do a dissolve, a wipe or a key. A key is just another special type of switch. Whereas wipes are generated by pattern generators in the switcher that determine switching points in the video, video keying circuitry generates switching patterns based on the video being keyed. An internal key uses the video being keyed to generate the pattern, where an external key uses a source that separately generates a key signal, also known as the "whole cut" signal, and the actual keyed video, or fill signal. Each effects bank on this switcher could perform only one operation per bank, either dissolves, wipes or keys. In addition, the path through the switcher was fixed. This meant that each effects bank fed the one below it, but not vice versa, starting with the top effects bank and leading finally

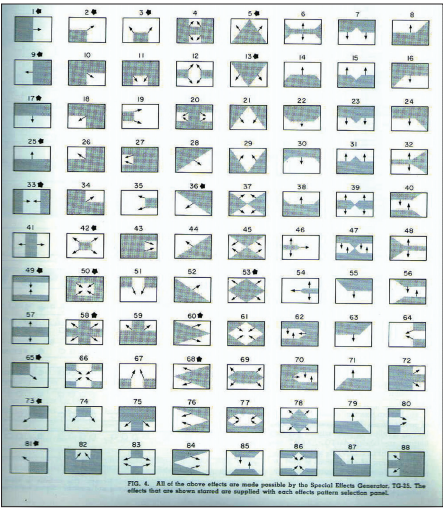


Figure 6.35 As we have said the video switcher has two basic operations, but switching still became much more complex. Video switchers originally switched to a new source the instant the operator made the switch. As this usually happened during the active video, large glitches were visible during most switches. So, soon the switcher was designed to wait until the next vertical interval (space and time between one video field and the next) occurred. Also, the art of electronic switching soon improved to allow glitch-free switching during the video. Someone then struck upon the idea of switching not only during the vertical interval, but also many times each field. The video "wipe" was born. Here is an early selection of patterns of available wipes for switchers. At first the ability to wipe was an option. If video was alternately switched back and forth between two sources twice per line, wipe pattern 1 was generated. If twice per field, pattern 25 was generated. If "multi" switching between two sources happened at varying horizontal and vertical rates, then the gaggle of patterns shown here was possible. A fader bar would change the timing of these switches as it was moved, thus in the case of a wipe the old source would appear to be "wiped" over by the new source as the fader was moved from one end stop to another. Now the fader arms controlled dissolves and wipes.

Switcher Re-entry

Re-entry is the process of delaying a downstream effects bank to match an upstream bank so the two match in time. This allows an upstream effect to be combined with a downstream effect, or simply a source in the downstream bank. All banks are used to get the same sources and if an effect is done in the upstream bank and then sent to the next bank, that upstream video has gone farther when fed to the next bank than the video coming straight into the downstream bank.



**Figure 6.36** A GVG-300 on an ABC truck in the late 1980s. This switcher greatly pushed the state of the art forward. It allowed each bank to perform dissolves, wipes and keys all at the same time. It also was the first to allow random re-entry. This means that there was no fixed cascade from one effects bank to the next. Any effects bank could feed any other. This switcher also had "E-Mem," to remember effects and transitions that could be recalled by an effects bank with a single push of a button. This allowed a larger selection of transitions and effects to be used in a production and allowed the pace of complex visual presentations to increase dramatically. This switcher still had its control panel tightly integrated with the electronics in the actual switching frame. Although there was some serial communications between the panel and the switching frame, there were also many thick cables that went between control panel and frame. (Source: A.F. Associates)

#### Random Re-entry Mischief

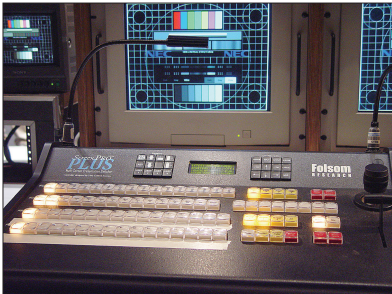
*This feature sometimes played havoc with side-by-side remotes, where a truck covering a game for the visiting team might take a feed from the truck covering the home team, and simply augment the feed with a few additional cameras and sources. In cases like these, a clean feed, with no keying of graphics, will often be provided by one truck for the other using a 300 effects bank. The away truck would be locked to the home truck, that is gen-locked, and the away truck's sources would be timed to match the feed from the home truck. Now if the home team truck's TD re-ordered which effects bank cascaded into which, the switcher would re-order the re-entry delays, changing the timing of the bank feeding the away team's truck. Any graphics keyed, or other sources dissolved or wiped to, would show up as the wrong colors or have other interesting color shifts during the effect or transition between the home feed and the away truck source. Today, with most trucks carrying multiple frame syncs, that problem is easily eliminated.*



**Figure 6.37** Control panels for today's switchers are now really only a user interface that is comfortable to the TD. Unlike earlier switchers, where each button, knob and fader actually had a separate connection back to the switching frame, now the panel interprets what the TD wants to do and via a LAN conversation tells the frame, or tub as it is also known. Control panels over LANs also allow a single control panel to control multiple switching frames. Thus the TD in one truck could control the video switching in two separate trucks. For instance, two different trucks that use different graphics packages, booth cameras, and open, closing and transition "bumpers," but that use the same game cameras, could be controlled by a single TD. (Source: Jason Taubman)



**Figure 6.39** Sony DVS-7000 switcher control panel used for ABC's Monday Night Football. Each TD sets up their board based on their experience, the particular board, and the needs of the director and show. This photo shows another interesting facet of today's switchers. Notice that the various effects banks are labeled with different sources. Switchers today are also routers. These switchers can often input 64 or more inputs, many more than the 30 or 32 buttons now common per bank. Switchers today literally allow a "shift" between one group of sources and another. Many think that the switcher and router will merge into a single system on many trucks.



**Figure 6.38** A "component" video switcher allows switching between computer sources and regular composite video sources such as cameras, with the proper interfaces for feeding projection monitors used in conjunction with a show.

Until recently, the button or knob you had your hands on determined which circuit or subsystem in the tub was being controlled. Not any more. Using very high-powered DSP technology, video is often manipulated as a series of layers based on button pushes and knob turns, and not as a series of separate effects handed off from one effects bank's circuitry to the next. In fact the traditional control panel could be replaced by a computer GUI, except that most TDs would argue that the traditional control panel allows for much faster operation. They say a single glance of the panel gives a complete video composition situation that would require paging through multiple screens on a computer GUI.

Today's switcher might look similar to its ancestors, but internally it is a new species. Much of the switcher's new architecture is to support the graphics sources that comprise such a large part of many telecasts now. In the next section we will see how increasingly sophisticated graphics engines have changed the look and feel of television. ■

**Figure 6.40** Right: Since the digital effects device was not that versatile until the computer was incorporated into it, these devices tend to have more of a computer-type user interface. Also, they are usually loaded up with effects before the show, and only the recalling of those effects is required during a show. The DVE/DME is treated as another source into the switcher. Often one or more effects or auxiliary banks from the switcher serve as the DVE/DME inputs; therefore, video paths involving these devices can become convoluted. Here the "effects" TD programs an effect into the device for an entertainment show. Many entertainment shows have two TDs, one who operates the main production switcher, and one who operates the DVE/DME. The TD here will not only operate the effects device, but will also switch sources feeding projection screens used in the production using the small switcher on the left.

