

# Design, Construction and Operation of a Mobile Television Production Van

By CHARLES E. COLBY

With the rise in demand for more on-location shooting of television shows, commercials and sporting events there came a need for a sophisticated mobile television production van. A van 40 ft (12.20 m) long and 8 ft (2.44 m) wide has been designed and built with the latest solid-state equipment. It features two VR-2000B videotape recorders; one HS-100 videodisc recorder; a 20-input, 11-output bus video switcher; a 60-input, 4-channel output audio console;  $\frac{1}{4}$ -in (6.35 mm) audiotape recorder; two cartridge recorders; turntable; and six color cameras plus two monochrome cameras, one mounted on a film chain, and the other a portable unit used for graphics and insert keying.

**B**UILDING this van for outside broadcast or on-location shooting was initiated by Transmedia International Corp., the world's largest mobile television van rental organization, who wanted "the finest mobile production van in the world, no matter what the cost." The result was a 1.5 million dollar 40-ft (12.20-m) unit that contains more equipment than any other TV mobile unit ever built (Fig. 1).

With the high cost of film production and a market demanding more and more on-location shooting, especially for television, TV production units of this type will lower the cost of production by doing the initial shooting directly on videotape rather than on film. The advantage of being able to play back immediately the scene and other capabilities such as instant effects, editing and slow-stop-reverse motion can save innumerable hours and dollars in any production.

The van did its first show in September 1970 — the California 500 Indy-type race at the Ontario Motor Speedway. Since then it has been on the road con-

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Fig. 1. The Transmedia television van.

stantly and has done many live network shows.

In designing the van, a 1/10 scale 4-ft (1.22-m) model (Fig. 2) was built as a feasibility study. In 1971 it was used by Transmedia for sales demonstration when the van itself was on the road.

The van is divided into four sections: Production Room, Audio Room, Video Room and Tape Room. These are separated by walls or glass partitions that permit each group within a section to function without disturbance. Anyone within the van can talk to anyone else in the van or to people outside the van (cameramen, floor directors, etc.) via a two-channel Interphone System.

## IFB System

The van is equipped with an IFB (Interrupted Feed Back) system that allows anyone in the production or audio room to talk to any one of 15 positions, such as announcers, outside the van. Normally, the on-the-air announcer would be receiving any one of four (switchable) program audio channels in both earpieces of his headset. When someone pushes the button to talk to him, the program audio in one earpiece is interrupted with the voice, while the announcer continues to hear the program audio in his other earpiece.

The IFB System is also used as an adjunct to the Interphone System within the van to provide communications without the need for wearing a headset. Speaking into any one of nine gooseneck-mounted microphones located throughout the van causes the response to be heard on speakers within each of the van's four rooms.

## Telephone System

In addition to the Interphone and IFB Systems, there are 15 telephones in the van, each equipped with a 5-line pushbutton selector and earphone jack. These provide a means of keeping in contact with all of the many people involved in doing a live remote network show, including the telephone microwave people and the network production and engineering people.

## Air-Conditioning

The front-mounted 8-ton air-conditioner provides cool air or heated air as needed. Air is distributed throughout the van in ducts within the false ceiling, with a louver-controlled supply and return air outlet located in each room.

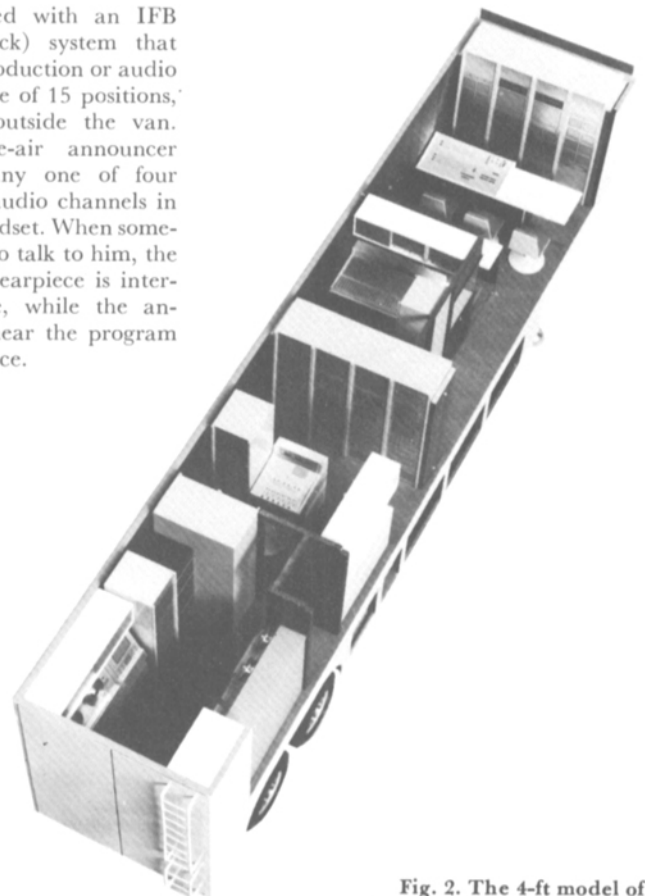


Fig. 2. The 4-ft model of the Transmedia television van.

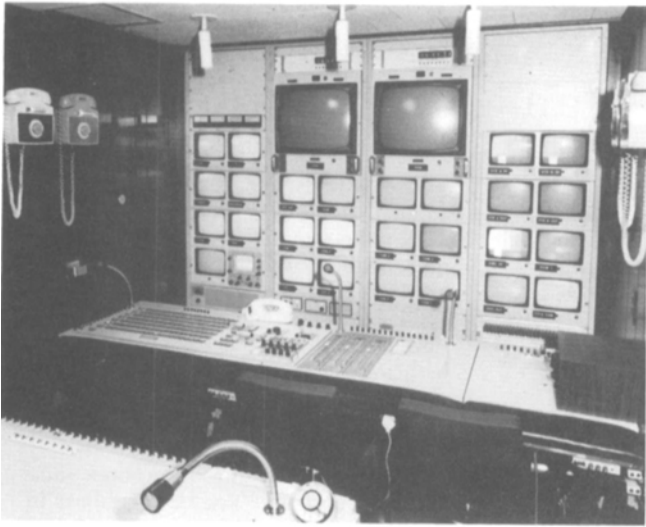


Fig. 3. The Production Room.

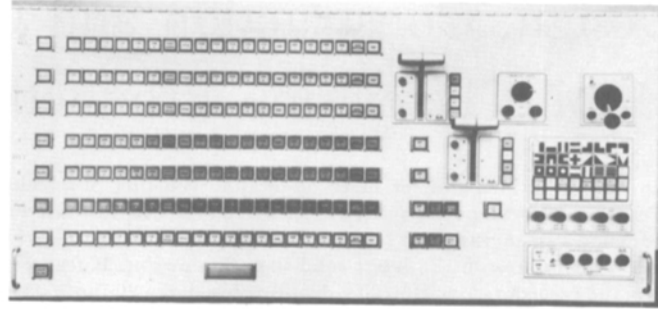


Fig. 5. The Audio Room. The turntable may be seen through the glass window. The Rear Production Desk is in the foreground.

### Lighting

Several types of lights are used within the van, including dimmer controlled, ceiling mounted, miniature spotlights, which are used during the time a show is in production. These lights may be positioned by means of their swivel bases to provide light in the right place without letting light fall on the monitors and wash out the picture. A general illumination light in the ceiling of each room provides brighter light for use when a show is not in progress. Another dc emergency lighting system automatically comes on if an ac power failure occurs.

### PRODUCTION ROOM

The Production Room (Fig. 3) contains 27 black-and-white picture monitors and 2 color monitors by which the director can see at a glance every picture source available for him to use. For the Technical Director there is a Video Switcher Control Panel (Fig. 4) that contains 275 pushbuttons plus 20 additional knobs and levers and a positioner.

The Video Switcher Control Panel has provision for 20 video inputs plus color black. The key bus is in the top row of pushbuttons. Output of key bus can be entered into the effects system by means of a button on the insert/background color control panel, located at the lower right of the main panel. The next four rows of buttons are effects one and effects two, each with A and B buses. A fader arm for each of the two effects permits transition such as mix, wipe, key and matte to be controlled smoothly. The

cut bar is below the preset bus. The quad split generator in the switcher permits four separate pictures to be displayed at a time on program and preset buses.

The Chroma-Key control panel is to the right of the top fader arm. The positioner in the upper righthand corner of the panel enables the operator to move effects patterns and spotlight around on the screen. The knobs near positioner make it possible to modulate patterns and control amplitude and frequency of modulation.

The effects generator has 23 push-button wipes plus an unlimited number of special patterns that can be made by means of a group of switches below panel. When the button marked FILM 1 POS is pressed, it is possible to use the positioner to change position of the picture from the film chain camera in relation to background picture without physically moving either camera or slide in relation to one another. Three more output buses of the switcher, which control inputs to the three videorecorders, are on the panel which is mounted on the front production desk to the right of the main Video Switcher Control Panel.

There is a front production desk and a rear production desk. The position at the left of the front production desk is usually occupied by the Technical Director. With the Video Switcher Control Panel in front of him, he has charge of pressing the right button at the right time, as commanded by the Director, who sits in the center of the front production desk. The rear production desk

has foam cushioned bench seats to accommodate three to four people comfortably. It is raised 8 in (20 cm) off the floor for easy viewing of monitors. On the rear production desk there are microphones and a row of switches used for talking to outside announcers and to other sections of the van. The small center panel on the desk is a remote control for the digital readout timer, located in the forward rack, above the program color monitor. The Video Switcher Control Panel is visible in the background on the front production desk.

The Production Room contains a digital readout crystal-controlled time-of-day clock; a digital readout timer with remote control, used as an "electronic stop watch" for exact timing of lengths of show segments; four VU Meters for monitoring the levels on the four audio output channels; and a Production Audio Monitoring System which makes it possible for the Technical Director to monitor any one of the 10 most important audio input channels, including the interphone. Also included in the Production Room is a video and tally patch panel that makes it possible to move any one of up to 29 video sources to any of the 29 picture monitors so they may be grouped for easy operation by different directors and for different types of shows. The identification signs for each of the monitors are held in place with magnetic material so they may be easily moved after video and tally patching is completed for a particular monitor.

On the front production desk is a Video Switcher Control Panel for each

of the two videotape machines and a videodisc recorder, so that any one of 24 inputs may be selected for the input of any of the machines.

Also, on the front production desk is a control panel for random access selection of any of 50 slides in the 35mm slide projector located in the Video Room in the center of the van.

### AUDIO ROOM

The Audio Room (Fig. 5) is located directly behind the Production Room and is separated from it by a glass partition which provides sound isolation, yet enables the audio operator to see into the Production Room.

The Audio Operator has complete control of the sound portion of the program. He mixes sound from the various sources, such as microphones, pre-recorded  $\frac{1}{4}$ -in (6.35 mm) tape, turntable, cartridge recorders, videotape recorders or remote inputs, to form the final program sound.

The Audio Control Console (Fig. 6) has 20 input mixing amplifiers, each switchable between two microphone inputs and one high-level input, such as the output of a tape machine. This means that up to 40 microphones and 20 high-level inputs can be combined in doing a show. Colored overlays group sections together for fast location of a particular pre-amp.

The righthand section of the console has linear faders to provide "at-glance status" of each input and output. There are nine submasters for each of the four output channels plus an overall master. There are four output program channels plus a cue channel on the console, which makes it possible to do shows requiring up to four separate language audio channels.

Other uses for the four output channels might be: one main audio feed to the telephone company plus one to three back-up feeds; main audio feed, back-up feed, and one channel for audio editing of a different program; two channels for a stereo recording session plus two back-up channels; and all four channels for recording a quadrisonic sound for a show.

The cue channel amplifier enables the audio operator to monitor any input channel independently of the four 80-W theater-type amplifiers used to distribute sound throughout the van.

The Audio Control Console also has provisions for reverberation, studio sound speaker volume control, talkback to studio, four built-in compressor-limited automatic gain amplifiers, audio slate provisions and a built-in variable frequency tone generator. There are removable panels in the console that permit easy access to the rear of the equipment.

### Additional Audio Room Equipment

Located over the Audio Control Console is a cabinet which serves as a storage compartment for microphones and other accessories, the previously mentioned IFB System and its control panel, and the four 80-W rms program audio amplifiers.

To the right of the Audio Control Console is an equipment rack which includes the audio jack field. It is comprised of nine audio jack panels, each containing 52 jacks for a total of 468 individual jack positions.

The audio jack field is used for testing and maintaining the audio system and is of great value in keeping the show on the air in case of an on-the-air audio equipment failure.

It is through this audio jack field that every input and output of every piece of

equipment in the audio system is available. By inserting a patch-cord (tip-ring-sleeve type for balanced lines) between any two or more jacks it is possible to alter the normal connection of the input-output routing of any of the various equipments.

Below the audio jack field is located a 2-channel  $\frac{1}{4}$ -in audio tape recorder, a 12-input audio switcher control panel, a dual audio cartridge recorder and 20 audio distribution amplifiers.

### VIDEO ROOM

The Video Room is behind the Audio Room. It contains 8 camera controls and 4 operators. In the Video Room the pictures from all six of the van's color cameras are made to look as perfect as possible (Fig. 7).

In the Video Room, the matching of the color qualities of all six cameras is under the final control of the Senior Video Operator. He sits at a sloping front console with, among other controls, a red, a blue and a green knob for each camera in front of him. By turning these knobs he can "paint" each camera to make the color quality from each camera match, so that the green football field doesn't look brown in one shot and purple in another.

The Senior Video Operator has the help of three or four other video operators who sit in front of the six Camera Control Units mounted in four side-by-side racks. These racks are mounted transversely in the van. They also contain six 14-in (35.6 cm) black-and-white monitors, waveform monitors, a vector-scope and two color monitors used in camera color matching.

To the left of the Senior Video Operator's sloping console is an equipment rack containing a tuner for receiving and



Fig. 6. Inside the Audio Room, looking toward the Production Room.



Fig. 7. The Video Room.



Fig. 8. The Videotape Room, looking toward rear doors.

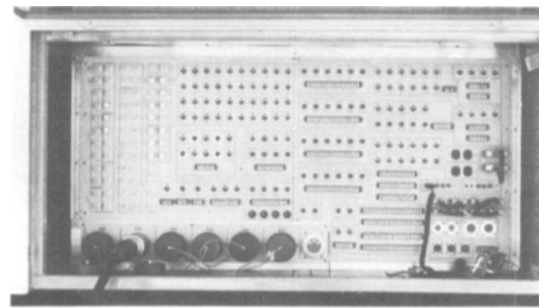


Fig. 9. The External Connector Panel.

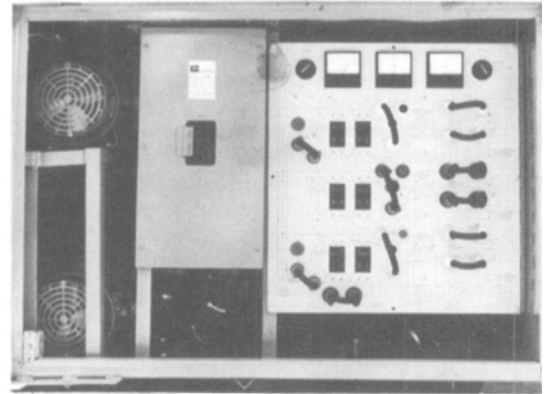


Fig. 10. The AC Primary Power Patch Panel.

monitoring the picture off-the-air as transmitted by the local television station. Below that are nine video jack panels, each containing 48 video jacks. Every video input and output of every piece of video equipment is brought to this jack-field and the operation is the same as the operation of the audio jack field in the audio room.

A 9-in (22.9 cm) black-and-white monitor and a waveform monitor are provided for setup and operation of two black-and-white cameras. One camera is on the slide-only film chain titling camera which is mounted on top of the storage cabinet located at the Senior Video Operator's right. The other, a monochrome 1-in (25.4 mm) Plumbicon, viewfinder-type camera, is normally set atop a tripod and used outside the van for graphics — the pickup of artwork that is colorized and keyed or matted into the final picture by the video switcher.

The camera control units for these two cameras are located in the lower section of the rack along with a channel 6 RF modulator. The RF modulator is used to feed a video and sound program out of the van to standard TV sets (without a video input jack).

Directly behind the Senior Video Operator, there are two equipment racks. The entire right rack contains the Video Switcher electronics and cross points for the video switcher.

The video switcher has 20 inputs and 11 output buses. Also provided are dual effects generators (one portable for use outside the van), a quad-split generator,

a border generator and the downstream keying capability. It is here that all of the video signals within the van are routed by touching one of the 275 buttons on the video switcher control panel located in the Production Room.

The left-rack contains a 14-in pulse-cross transmission monitor and waveform monitor, and below there are a color bar generator and a test generator with an output switcher, for setting up the entire video system within the van.

Next is a Chroma-Key switcher used to select one of the six color cameras to do a Chroma-Key special effect.

Below that is the dual sync generator that generates the six timing signals and pulses that are the references for every piece of video equipment in the van. It is a dual unit with an automatic change-over switch that senses the absence of any one or more of the six timing pulses and automatically switches in the other sync generator in the event of a failure of the first one.

Below the sync generator is a processing amplifier system that can be patched anywhere in the system and used to "clean up" a noisy or otherwise unusable signal such as might be encountered when accepting a "remote input" from outside the van.

Under the processing amplifier are 49 video and pulse distribution amplifiers used to amplify and provide a means for setting levels of all the video and pulse signals that are distributed among all the pieces of video equipment throughout the system.

#### VIDEOTAPE ROOM

The room at the rear of the van (Fig. 8) contains two Ampex VR-2000B Videotape Recorders, one with editor and EDITEC (TM, Ampex Corp.), and an Ampex HS-100 Video Disc Recorder.

The VR-2000B 2-in (50.8 mm) quad-head recorders are fully equipped with every available option and are used to record the program material. Having two recorders permits editing to be done within the van, making it feasible to assemble a complete show without the need for a post-production facility. The HS-100 Video Disc Recorder is used for effects calling for slow-stop-reverse action and "instant replay" when the van is covering a sporting event.

All three videorecorders are removed quickly and easily from the van by releasing self-locking type pins and rolling the machines through the full-width rear van doors onto a fork lift. Smaller doors on the sides of the van provide easy access to the rear of the recorders for service or maintenance when they are in position in the van. Cabinets are built in over the videotape recorders for storage of tape and technical manuals. An equipment rack in the tape room has a color monitor and vectorscope with input switcher for monitoring and adjusting the VTRs.

There is an input video switcher panel for each videotape recorder in this rack, enabling the Tape Operator to select any one of 24 video inputs or 12 audio inputs for each machine. These panels

are remote-control extensions of the main video switcher and, since all video switching is done within the main video switcher, timing problems are non-existent. The control panels are in parallel with the panels in the Production Room and operate on a "whoever pushes the button last gets control" basis. This permits the inputs to the videotape and disc machines to be switched either from the Production Room or from the Tape Room and has advantages in different modes of operation of the van, such as selecting an "isolated camera" shot from the Production Room, or doing editing from the tape room only with no one in the Production Room.

The lower half of the rack contains a 9-in black-and-white monitor and a waveform monitor used in operating the HS-100 Video Disc Recorder, which is located to the right of the rack.

The dropout-compensators for the VR-2000B Videotape Recorders are located at the bottom of the rack. In the rear curbside corner of the van is a short rack containing three 60-A ac primary voltage regulators.

Industrial grade carpeting throughout the van helps deaden noise and control dust. It is especially important in the Tape Room in helping to keep dust on the floor away from the tape and rotating video heads on the videotape recorders.

#### **External Connector Panel (Fig. 9)**

This connects all of the audio, video, pulse, intercom, IFB control and camera cables between the systems in the van and the outside world. The only other connectors required to the van are for ac power and telephones.

The external connector panel contains 266 connectors and measures approximately 54 by 105 in (137 by 267 cm). It is designed with a unique swing-out feature, making it easy to gain access to the rear of either of the two swing-out sides. The camera cable portion of the panel does not swing out

because of the larger, hard-to-bend cables going to the bulkhead-mounted camera cable connectors. Video cables go through the panel via feed-through type connectors. Many audio, intercom and control cables each terminate in several types of connectors and terminal strips for fast connection when the van is being set up on location.

To make efficient use of space in the storage compartments under the van, some of the telephone terminal equipment is mounted behind the external connector panel, but is still readily accessible because of this swing-out feature of the panels.

#### **Telephone Connector Panel**

The connections to the 15-position 5-line telephone system within the van are provided on a panel that is located next to the main external connector panel. Also mounted in this area are five switches used to determine the status of one switchable line on each telephone which can serve either as a regular business line or as a special-purpose line, for example, an automatic ring down line to a phone somewhere outside the van. In operation, picking up one phone and pushing that line button automatically rings the phone on the other end of the line without the need for dialing — handy if you are in a hurry to get in touch with someone.

The outside portable phones supplied with the van have a choice of switching between a bell and a light so that they can be used near an on-the-air announcer without the bell's ringing.

#### **Camera Cable Reels**

Each of the six camera reels holds 500 ft (150 m) of camera cable. Each has a reversible drive motor, with a foot-operated switch, which frees both hands to handle the cable when reeling out. The cable reels may be operated with power assist in both the reel-in and reel-out modes, making easy work of an otherwise tiring job.

#### **AC Primary Power Patch Panel (Fig. 10)**

This is located in the rear of the van, in the underskirt storage area next to the power cable reel. The main purpose of the patch panel is to enable the van to be operated from either single-phase 240-V power or 3-phase 208-V power. This is important because getting power in different locations is often a difficult problem. Of course, a portable generator may be used, but this can lead to problems because of the noise of the generator engine. Other features of the patch panel include provisions for changing voltage taps on the isolation transformers by changing patches, provisions for patching around voltage regulators in emergency (problem) situations, and circuit breakers for independent control of each of the three sections of the air-conditioner and each of the three ac sections in the van.

Three panel meters provide complete monitoring of the following parameters of the ac system:

- (1) Voltage meter is switchable between each of the three 208-240-V primary phases.
- (2) Current meter is switchable independent of the voltage meter to any of the three phases.
- (3) Frequency meter is a fast-acting electronic type that is useful in setting up operation when a generator is used to power the van.

Three 10-kVA isolation transformers provide ground isolation to help eliminate ground loop problems often encountered in mobile equipment. A voltage regulator on each of the van's three ac sections makes possible operation on primary voltage that can vary as much as  $\pm 20\%$  at different locations.

*Note:* The van is now owned and operated by Western Telecasters, Inc., San Diego, Calif.