AES

Audio Engineering Services LLC

Live-to-Air
Audio Production
Backup Strategy

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Abstract

Live television production companies plan and budget for technical redundancy in critical systems to prevent the loss of program during live on-air transmissions.

Show power is typically provided by dual-redundant diesel powered electricity generators. Switchover to the backup unit in the event of a problem with the primary power generator unit is automatic.

Independent Satellite uplink transmission trucks will normally be employed for the transmission of the live event program.

The cost of primary power and transmission uplink redundancy is substantial. With respect to this financial commitment, failing to utilize available equipment to support the philosophy of redundancy is foolish, or even negligent.

Audio Production Backup in the Television Production Truck

Program Source Transmission via Satellite uplink

The primary television truck creates the program content fed to the primary and backup satellite trucks. Each satellite truck will be connected with redundant sets of analog and digital signal lines for two independent program mixes. These signals are typically called main program, with a full mix of all program elements, and the international mix, which typically will be the program mix minus the dialog of the domestic language. These two signal sets, both dual channel, Main and International Primary Program, Main & International Backup Program, in both analog and digital formats are uniquely generated for each of the Primary and Backup Satellite uplink trucks. Technical communication with each satellite truck is required.

Signal feeds to the satellite trucks must be controllable for testing and QC purposes, and will be fed from analog and digital routing control systems on the production truck. The backup strategy for the analog & digital audio router control in the production truck is a prepared exercise of physical hard patching into the transmission line feeds to the satellite trucks.

The satellite truck operators are principally tasked with responsibility to switch between primary and backup uplink trucks, and interactively monitor the down linked signal quality with the receiver sites. The satellite uplink operators do not have the rapid analytical tool set to independently make the changeover decisions regarding the audio signal sources.

When digital audio signals are the principal transmission source, the satellite truck operators can make a hard digital patch to the backup signal line, or change the modulator mode to analog input. These decisions are not automatic, and will not usually be implemented without direct instruction from the production truck.

Table 1: Signal Feeds To The Primary & Backup Satellite Uplink Trucks

PRIMARY SATELLITE UPLINK TABLE OF SIGNAL SOURCES:
1. Primary Full Program - Analog L&R
2. Primary International Program - Analog L&R or Mono
3. Backup Full Program - Analog L&R
4. Backup International Program - Analog L&R or Mono
5. Primary Full Program - Digital L&R
6. Primary International Program - Digital L&R or Dual mono
7. Backup Full Program - Digital L&R
8. Backup International Program - Digital L&R or Dual Mono
9. Confidence Return Line L&R analog to Production truck
10. Confidence Return Line L&R digital to Production truck
11. Engineering Communication Party Line

BACKUP SATELLITE UPLINK TABLE OF SIGNAL SOURCES:
1. Primary Full Program - Analog L&R
2. Primary International Program - Analog L&R or Mono
3. Backup Full Program - Analog L&R
4. Backup International Program - Analog L&R or Mono
5. Primary Full Program - Digital L&R
6. Primary International Program - Digital L&R or Dual mono
7. Backup Full Program - Digital L&R
8. Backup International Program - Digital L&R or Dual Mono
9. Confidence Return Line L&R analog to Production truck
10. Confidence Return Line L&R digital to Production truck
11. Engineering Communication Party Line

Note: Audio Multipair Signal wire runs to carry the above listed signal lines will
include:
1 each 12 pair analog snake to each satellite truck
1 each 6 pair digital audio snake to each satellite truck

Production Truck Audio Signal Router Control

The audio signal router control is a subsystem, operating in parallel with the video router control subsystem. Routers are electronic switches under the control of a master router program, described here as the "Router". Multiple vendor sources of router/switcher hardware are controlled by the master router software with associated interface control panels. The physical size of the router related hardware, and the master program control integration to the audio & video control systems preclude the practicality of redundant router systems. The Router therefore becomes a known single point of failure to be considered.

Router control system failure modes:
1. Failure to respond to software command
2. Power supply failure in the router/switcher control unit
3. Local circuit failure

Failure to respond to command: A communication instruction to make changes within the hardware signal switching is not executed. The prior switch states remain unchanged.
A hard patch connection will over-ride a failure to respond to control instruction. The probability is low due to the high level of reliability required in the video switcher / router control software.
A failure to respond in the video router control subsystem is a show stopper.
A router control subsystem software reboot can generally restore control over the hardware switching without interrupting the audio/video program flow.

Power Supply Failure: The router switch hardware chassis frames will be equipped with dual redundant power supplies. A failure in one supply will not compromise system operation.

Local Circuit failure: Partial, or complete loss of audio signal within a single input or output. Redundant paths within the hardware router can be used to compensate, in addition to hard patching around the signal switch.

The audio signal distribution to the satellite uplink trucks must be controllable from the EIC position of the production truck to facilitate QC testing of the satellite signal paths independently of the show production rehearsal schedules. The audio signal router is inherently part of the audio program distribution from the production truck.

The audio signal distribution to all the video and audio recorders must be controllable form the EIC position of the production truck to facilitate QC testing of all record paths independently of the show production rehearsal schedules. The audio signal router is inherently part of the audio program distribution to all recorders on board the production truck.

The production audio router subsystem is a network of electronic switches. When the switch has been closed, will tend to remain closed until commanded to open. Likewise, the reverse is true with respect to open switches. The production audio router subsystem can provide a unique ability to seamlessly switch large groups of audio signals under a macro command control definition. Audio routers are designed for inaudible switching transients between signal source selections. The audio router subsystem can be an efficient tool for implementing a larger plan of redundancy in other sub sections of the audio production, including the Audio Production Console.

Audio Production Backup Strategy

The audio production console represents a single point of potential failure. Large format digital audio consoles provide unparalleled control and instant reset capabilities as compared with analog format consoles. Large format digital audio consoles also introduce a risk of partial or total audio program failure. The hardware normally exists to provide a redundant backup to the main audio production console by using a compact secondary mixer programmed with the

essential elements. Integrating the backup hardware plan during the initial equipment setup will allow the system to be rehearsed and fire drill tested with the production team members.

It is important to generate a logical switchover architecture allowing for local decision making, partial system switchover, or total system switchover.

Signal sources types for redundant routing

Production microphone signals are fed to stage area local passive / active splitter systems. The front of house (FOH) audio console, stage monitor audio console, and the production truck all receive copies of the microphone signals. A redundant strategy for the production truck is to provide 2 output splits from the main microphones over two lines for each signal. A passive subsplit at the main signal splitter for the production truck may be used for generating the redundant signal lines to the production truck.

Video Tape (VT) Playback signals are all delivered to destinations via the production audio router control system. Multiple redundant paths are easily generated with the production audio router. Hard patch access to the VT playback lines may also be available for connection to a backup mixer.

Audio Tape (AT) playback signals, including signals originating on digital hard disk drives that do not have associated picture elements can be introduced to the production audio router, and then delivered to multiple destinations. Pre recorded announcements are usually played out on cue by the AT playback engineer, however the announcement signals should be fed to FOH on dedicated ANCR signal feeds.

Production Audio Control Console Backup Mixer Strategy

The main production audio control console will have full control over all elements used throughout the rehearsal and transmission. The backup audio control console will have copies of the essential signal elements, and may include a backup submix generated on the FOH console.

The Production audio mixer will normally provide the AT & VT playback signals required by the FOH mixer position for the live show. A unique and dedicated backup line should be generated from the backup mixer which will contain the sum of the AT + VT + Ancr elements.

The FOH mixer creates a unique and independent mix for the venue. This mix will be dependent on the AT & VT playbacks, and may also require pre-recorded Announcement playback The FOH mixer may at anytime access the backup line for confidence check, or alternate to the primary elements in the event of a defect in a primary element signal line.

FOH Backup: A 32x32 analog router matrix may be employed at the FOH position to provide a backup strategy similar to the production audio console. The backup signal sources may include feeds from the production truck and feeds from the monitor control console. When live

bands perform onstage, the FOH console can generate a band submix for delivery to the production truck backup console.

Manual Switchover preparation

Signal sources from the backup audio console, the AT production console, the FOH mixer should all be available on patchcords for rapid direct patch to destinations.

Production Truck Router Implemented Switchover

Each of the main and backup production audio consoles generate the audio mixes fed to the Router source inputs. The audio signals which must be active to continue show production can be delivered as destinations from the audio system Router. These audio signal destinations can be gang-switched simultaneously with a macro command to the Router, switching from primary signal sources to the backup console signal sources. When the main and backup audio consoles are set for normal show production balances, the actual Router switchover implementation will be inaudible.

In the event of a total failure in the main audio production console, the master gang switch command decision can be made and implemented by the audio & video EIC's within 3 seconds. Subsection commands can additionally be created to selectively switch backup subsystems on line.

Table 2: Essential Production Signal Backup

1. Transmission feeds
2. Analog program distribution
3. Digital program distribution
4. VT Playbacks to FOH
5. AT Playbacks to FOH
6. Announcer / pre-recorded Voice playbacks to FOH
7. Program mix to VT
8. Mix minus/stem mixes /iso prefader feeds to VT
9. Audio mix to prompter
10. Program mix to party line communications
11. Audio control room loudspeakers
12. Production control room loudspeakers
13. Production mini speakers with talent prefader signals
14. Program sources to Interuptable foldback (IFB) system for talent ear monitors

Conclusions

As the scope of the essential production audio signals expands, the rationale for implementing a router based backup switchover becomes an essential tool to complement the traditional manual patchbay methods.   It is interesting perspective to compare the physical patching implementation for a router based backup system with the conceptual adaptation within digital signal routing environment; The physical patch setup, while complex in volume, is not a big deal, as this volume of digital audio routing is routinely accomplished within 6 square inches of silicon DSP. Consider how much DSP is actually utilized in the production truck, and the router based backup strategy becomes a logical and cost effective choice to make. It is far better know that the ROUTER is a healthy beast by using the available features of the ROUTER in the backup strategy because ultimately, the actual transmission feeds to the uplink birds are being sent by that same ROUTER.

Figure 1: Sample Audio Production Back-up Scheme