Sound Score Playback Options: part one

by
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Part one of this article describes options for sound score playback devices commonly used in live performance environments. Part two, scheduled for publication in the next issue (fall, 1998) will compare specific devices from specific manufacturers.

A couple of years ago the 3M company stopped making analog audio tape products, including the paper and plastic leader tape which sound designers have used for years to help sound board operators distinguish between cues, and to cue up each sound for precise playback in a performance. For many, this marked the demise of the venerable and ubiquitous analog open reel audio tape recorders (ATRs). Why? Digital audio equipment offers greater flexibility, economy and convenience. In recent years, pioneering sound designers, engineers, technical directors and theatre producers have introduced a variety of digital products into the sound booths of theatres around the country. But everyone seems to have their own favorite pieces of equipment. Consequently, there is a great deal of confusion and disagreement over which digital audio systems are best for theatre sound recording and playback.

When theatre sound designers and technicians met during the 1997 USITT Conference & Stage Expo in Fort Worth to plan sessions for the following year's conference in Long Beach, the number one subject on everyone's mind was digital audio. At the annual Sound Commission meeting, Jon Gottlieb (Mark Taper Forum/Cal Arts), and Eileen Smitheimer (University of Delaware), stepped forward to co-chair a session on the topic. Together they gathered an impressive group of theatre sound practitioners, including Dave Tosti-Lane (Cornish College of the Arts in Seattle), David Smith (North Carolina School of the Arts), Carlton Guc (Stage Research in Cleveland OH), Ken Bell (Richmond Sound Design), Richard Zvonar (Level Control Systems), and EC Keller (South Coast Repertory Theatre) to participate in the session, "Sound Playback Options for Theatre," which took place for a capacity crowd on Thursday, March 19, 1998.

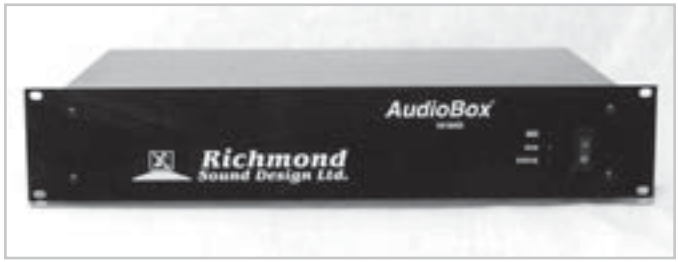
DIFFERENT PRODUCTS FOR DIFFERENT THEATRES

Two things became obvious during the Long Beach sound playback options session: first, different types of theatres have very different playback needs; and second, no single product really exists to address all of those needs. The first part of this report will focus first on specific types of playback devices, and then on how to chose a sound playback format that is right for your particular performing arts facility.

COMPACT DISC

The recording industry changed overnight with the birth of the compact disc. CDs are substantially smaller than the standard vinyl record, with a much larger dynamic range, the ability to locate and cue up tracks quickly and easily, and none of the surface noise that plagues analog recordings. Soon recordable compact discs (CD-R) appeared on the market, and before too long, the price of the individual blank discs plummeted so low as to make their biggest drawback—the inability to record on them more than once—a non-issue. Theatres began to experiment with compact discs as a playback medium, and many theatres found that they met their needs rather well. As Jon Gottlieb explained: "The reason for CD is that recordable CDs can be recorded with standalone CD-R recorders or recorded through a workstation with a computer CD-R burner. In general you need something that can burn for audio as well, not just for data. The cost factor for these has gotten very low, I mean if you get any lower, they're free. The benefit of CD-R is that you can archive until your heart's content, and at present there really is not a known life-span for CD-Rs. Basically what I do is take sound effects that I have mastered on workstations, or even on shows, and I will archive them to CDs. So, if I decide that I want to take a thunder from a show that I did in the past, I can stick it in any CD and play it. The thing you're looking for in a CD player is that it will stop and cue itself up again."

Typical multi-track hard disk playback unit: AKAI, model DR8.



Typical asynchronous multi-track hard disk playback unit: the Audio Box by Richmond Sound Design.

David Smith also discussed the advantage of CDs in the rehearsal process, particularly as it applied to dance sound: "One of the things to also bear in mind is what sort of performance you are doing. For those who are doing dance, CD is the way to go because you can give it to them and they can rehearse with their boombox. I would never go with any other system for dance playback, because the choreographers want to take it home with them, and they can take home a CD, and they can't take home a MiniDisc."

An audience member added to the discussion, saying, "Dance also needs CD players that have variable pitch control." This allows on-the-spot minor changes in tempo, something needed by all dancers when they are faced with adjusting to the differences between the rehearsal space and the performance space.

There are a couple of other issues that potential buyers should consider before investing in compact discs as a playback medium. First, compact discs systems require the theatre to invest in a CD burning system, and these burners are not necessarily the devices that theatres want to use to play back their cues (they typically don't have auto cue, direct access, and other important functions). Second, CD playback devices are not as user-friendly as other systems. Sound board operators must take the readouts of track numbers from the CD and make the mental translation to the corresponding cue number or sound name. This could increase operator errors. Also, when the director wants to change a sound cue, insert a new sound, or move a cue to a different spot, the designer will most likely have to burn a whole new CD. However, for many users, these disadvantages are outweighed by the advantages. CDs are a very stable and cost effective medium, and inexpensive players are available with fairly advanced features that allow quick starts of cues, automatic cueing to the next cue, and the ability to go directly from rehearsal tapes to insertion in the show or the production playback system. Another major advantage of compact discs is that just about everyone has a CD player. This makes it easy for the sound designer to share cues or even the whole show score with the director, production team, and performers.

MINIDISC

MiniDisc systems are currently in use in many theatres across the country. If a de facto standard has arrived for a piece of sound playback gear, the MiniDisc might be it. Why then do so many people seem to be embarrassed to admit that they use it? The reason for the somewhat seedy reputation of MiniDisc systems comes from the way it digitally encodes audio. The MiniDisc compresses standard 16-bit digital information into 8-bits using a compression scheme called Adaptive Transform Acoustic Coding (ATRAC). Dave Tosti-Lane summarized the controversy over the audio quality of MiniDiscs: "MiniDisc is a pretty remarkable piece of equipment. We all know what we're supposed to think about the MiniDisc. We all know we're supposed to think that it sounds like crap, and you could never use it because of all of the lossy reduction, data reduction. On the face of it, it's true—the amount of data that gets recorded on that MiniDisc is only twenty percent of the amount that you could record on a CD-R. So, a CD-R data rate is 1.4 Mbit/second, the MiniDisc is recording at a data rate of about 292 kbit/second. They have a very elegant scheme of data reduction. My sense with the MiniDisc is it's perfectly acceptable for basic cueing. I don't like to use them with really loud cues. My own personal bias is that they're a little bit granular in sound at very high levels. Again, sometimes I wonder...whether maybe I'm reading that into knowing it's a MiniDisc. I can also hear some differences with specific types of cues. For instance, a wind cue, something that has a lot of high end in the sound, the algorithm has no choice but to think of that as noise. It's designed to deal with popular music and hiss is not something that you want to play back in general. So, my own sense is that those cues just get a little bit odd on that kind of sound. So, it's hardly a be-all and an end-all, but at $300 dollars, it's a pretty inexpensive medium to work with." [The list price for the consumer model is $350.00, but street prices are typically below $300.00 –ed.]

If it weren't for the controversial character of the audio encoding scheme, the MiniDisc might be a perfect replacement for the standard two-track ATR. It's relatively inexpensive, starts up quickly, automatically cues to the next cue, provides for track titling so the sound board operator can verify that the deck is cued up to the correct cue, and provides a host of simple editing functions that allow the designer to fix cues on the spot. For example, the scene change that was supposed to be twenty seconds but is actually thirty seconds could be fixed on the spot by performing a simple non-destructive edit that looped one section of the cue for the extra ten seconds. The following comments attest to the inherent attractiveness of the MiniDisc format. One session attendee reported: "I work with students who are theatre students, and not even sound students, and they really take to the MiniDisc player. It looks like their cassette player at home and operates the same way. I have some students that look at the computer system and say, "I'll do the next show." That is one benefit I've seen with MiniDisc."

Tom Mardikes, USITT's new Sound Commissioner, also spoke of his experiences with MiniDiscs: "I just finished doing *A Comedy of Errors* for Missouri Rep on MiniDisc, and what was really great about using MD was that by building cues on Pro Tools, we could make a lot of changes, keep using the same MD and just add new cues on to end of it, rename, and we are set. The operator has the unit right in front of him and is looking at big cue numbers and big cue names. It is so much faster than reel-to-reel or CD buildups. In terms of that kind of flexibility, it was pretty fantastic. Sound quality is about a B grade. I say use MDs if the sound quality is not absolutely critical. A loud cue sounds better on reel-to reel analog. A cue that fades out is difficult for both the MD and CD formats. That will improve when we all jump to 24-bit/88.2kHz right?"

There are some issues that users of MiniDiscs should understand, espe-

Typical MiniDisc playback unit: Sony, model MDSJE500.

Typical compact disc playback unit: Tascam, model CD401.

cially related to consumer models of the MiniDisc. First, some models either don't have auto-cue functions, or require the user to activate it every time they turn the power on to the machine. Advanced features, such as auto-cue might only be programmable from the wireless remote, so it is important for the user to store remotes in a safe place.

Another issue that may be of concern when purchasing consumer model MiniDisc players is the ability to defeat consumer copy protection circuitry, the so-called Serial Copy Management System (SCMS). Somewhere in the user's production chain, they will want to make sure that they are able to remove this protection, or they may find it impossible to make backups, or even to dub directly from their primary storage medium.

Finally, users who want to backup their work will find the MiniDisc to be somewhat problematic. Only the top of the line Sony unit will actually make a bit-for-bit clone of the original, which would include titling of cues, and preserve the non-destructive edits (Denon also makes a unit specifically dedicated to this function). To back up using any other MiniDisc unit requires making a digital dub from one unit to another. Unfortunately, the dubbing process includes two stages of ATRAC compression: first when transferring the original material to MiniDisc, and second when recording the backup. Nevertheless, many designers use their original sources (e.g., CD, DAT, etc.) for backup, or are not bothered by the extra compression.

DAT

There is an inherent problem with using Digital Audio Tape (DAT) for theatre sound playback: the startup time after an operator hits the go button is unacceptably long. However, some theatres do use DATs for sound playback, particularly for dance productions. It is ubiquitous in recording studios where engineers master to DAT for CD production and archive and backup to DAT. It is, cost per megabyte, one of the least expensive recording mediums, it is re-recordable (unlike CDs), and DAT records in full 16-bit, 44.1 kHz sampling rate digital (unlike MiniDiscs). The DATs included in this report offer instant start and synchronization capabilities, e.g., the ability to synchronize lighting directly to music, and eliminate the need for internal "cue calling." Because of these features, users may want to consider investing in a DAT player, especially if it is part of their backup strategy, or they are involved in dance, and want both full fidelity and the ability to rerecord cues.

On the down side, DATs don't have the ability to automatically cue to the next cue, and you cannot edit them, so, if the director changes the order of the cues, the designer has to rerecord the show tape from the point of the changed order forward. To help reduce these problems, sound designers often leave at least a minute at the end of each cue to allow both re-recording of cues and as a buffer space to prevent board operators from accidentally running into the next piece.

TWO-TRACK HARD DISK

Several companies manufacture two-track hard disk units, but the most popular ones for theatre are the Digicart II Plus and The Instant Replay, both made by 360 Systems. They have found niches in both broadcasting and theatre, primarily because of their playlist oriented design, ease of operation, and programmability. Digicarts can be linked up via remote control to allow more than two tracks to simultaneously playback at once over more than two outputs.

Jon Gottlieb described the advantages of the 360 Systems products at the Long Beach session: "[They] work on the same concept that they are recording and playing back from an internal hard drive. The benefit of the Digicart is the internal editing. With this I can adjust heads and tail cuts, I can do fade-ins and -outs, I can adjust overall level. It's all very intuitive and very quick and non-destructive. It has it's nomenclature where it assigns cues to different places in the number one or number two directory or three directory, etc. You can store about a thousand cues in each directory and are only limited by the amount of space you have—space meaning time for overall recording time. (With a) 500 Meg hard drive you've got three hours of recording time (with) Dolby AC2 compression, or you can record in 44.1, and 48 kHz. You can also have all the cues that are on the internal hard drive exactly the same in a digital form on the Bernoulli drive to take back to the studio, so you don't have to leave with the show tape. [Most current models use Iomega's Zip Drive. –ed.] I'm very high on Digicarts. I use them extensively at the Mark Taper Forum. I love the delivery system. The Instant Replay is essentially the same as the Digicart except that it goes one step further in terms of instant access to different cues."

These two products from 360 Systems may be a near-perfect replacement for the two-track ATR. The only real drawback to the devices is their cost, which is out of the reach of many theatres, especially when backup and redundancy equipment are included in the budget. They also do not offer variable speed playback or synchronization capabilities such as SMPTE or Midi Time Control (MTC), features which are often included in similarly priced products using different formats.

MULTI-TRACK HARD DISK

Many theatres use stand-alone multi-track hard disk systems for theatre sound playback. One popular workhorse is the Akai D4M. It has earned its popularity largely because of its simplicity in operation, relatively low cost, and rugged reliability. However, Akai has discontinued the D4M and replaced it with an eight-track version, the DR8, and a sixteen-track version, the DR16, and these units, as well as those from E-mu Systems and Fostex are finding their way into theatres.

The main advantage of digital multi-track is that it allows theatres to

have multi-track, multi-channel output playback from a single hardware device. Some theatres combine a multi-track output device with standard two-track devices so that special cues with multi-track/multi-channel needs go on the multi-track, and the rest of the cues go on the two-tracks, where they are a little easier to deal with because of the two-track's capability to automatically cue to the next cue. Cloning (backup) of files is simply a matter of backing up the data to another hard disk (fixed or removable) through computer standard SCSI outputs.

ASYNCHRONOUS MULTI-TRACK HARD DISK

For years theatre sound designers have wondered why the computer sound industry could not add a simple feature to computer audio workstations that would make them ideal for use as playback devices in theatre. That feature is the ability to trigger cues asynchronously, i.e., to allow the user to configure, on a cue by cue basis, the outputs of the system to meet the needs of a given cue sequence. For example, in one scene, a sound designer might require one eight-track to start playing, and then, while that cue was playing, trigger a four-track cue. However, in the next cueing sequence, the designer might need to be able to trigger three four-track decks independently. After years of patient and often frustrated waiting, asynchronous playback devices have finally appeared on the market.

They are, of course, by far the most sophisticated devices available for theatre sound score playback. They allow the user to configure their audio playback system from a single computer monitor, for the number of decks required, the number of tracks allocated to each deck (within the limits of the system), and the number of output channels to which the tracks are routed, on a cue by cue basis. If there were ever a product whose time has come for theatre sound score playback, this is it. Generally speaking, these systems can handle just about any playback situation that can be thrown at them, and include many features designed to simplify and organize even the most complex cueing situations.

Perhaps the only downside to these systems is that they are computer based, and, rightly so or not, many theatre practitioners remain wary of incorporating computers into live performances.

Three such systems are now available that are specifically designed for sound playback for live performance. These are SFX from Stage Research, Inc., the AudioBox from Richmond Sound Design Ltd., and the LD-88 Digital Mixer with Wildtracks option from Level Control Systems. All three systems were demonstrated at the USITT conference in Long Beach.

SFX, from Stage Research, Inc. Carlton Guc, from Stage Research, Inc., demonstrated the SFX system, and made the following comments: "SFX is a Windows-based (NT/Windows 95) platform that allows us to create our sound effects on the computer, edit them, put them in a computer, and play them from the computer. It has the ability to do all of the things that linear sound devices do—you hit the go button, it plays, stops, the next effect loads up and the next effect is ready to go. The operator just needs to hit the go button to continue from there. On one side of the screen are cue status boxes, you can have as many as you want—you can have one, you can have ten. In those boxes, it kind of gives us a status of what's happening, you can fast forward a sound, rewind it. If I have a music cue that's ten minutes long and I need to get to the middle of it, I can easily get to it to continue teching the show. Other important features include individual cue notes, so any cue you click on you can put notes in the system so you know what they are. Probably the best feature in the system allows the operator to scale the size of the "GO" button. In a different work space, you can layer effects, scale volume, assign outputs, and, through the automation part of SFX, automatically add cues at predetermined start times in the sequence. In another kind of show, you can have multiple cue lists operating simultaneously, which allows you to independently cue sounds from any playlist similar to operating a multi-deck show. You can then create a master cue list that talks to the other cues lists, so that all of your cues appear in the proper order together in a single cue list. All of this is through a Windows interface, so it's drag and drop. The nice thing about a computer system also is the amount of time and money that you want to put into it, getting high end cards, low end cards, it's very expandable."

AudioBox, from Richmond Sound Design Ltd. Ken Bell, from Richmond Sound Design Ltd., demonstrated the AudioBox next, and included the following description: "When we started out to create the AudioBox, we wanted to do something different than just a playback system. We wanted to create within one box the equivalent of a rack full of equipment, that could respond to live control. We wanted to have the playback engine, we wanted to have a routing/mixing matrix, we wanted to add delay and processing, so that one box could store the contents and distribute them to the various zones of a themed venue without a whole bunch of equipment needed to do this. Inside the AudioBox, there is a 16 X 16 crosspoint matrix. Each crosspoint can be specified for level and the time, so you can fade up, and fade down, and specify both of those parameters via MIDI command. There is five seconds of total delay, and 80 bands of equalization assignable amongst the 16 inputs and the 16 outputs. The inputs are divided up between eight auxiliary analog inputs, to which you would connect front of house mikes, or preshow music sources, and eight streaming audio tracks from the on-board hard drive. Each of the tracks is independent, and can be started and stopped separately. With an on-board hard drive of 1.2 gigs, which is about as small as you can get nowadays, that's just over three hours of recording time. We've been asked about compression, but with the cost of media plummeting, this is not an issue. The system ships with 'AB Edit/AB Show' for Windows 95. 'AB Control,' a compositional, spatial program for the Macintosh, and 'Show Man' for Windows NT, are optional."

LD-88 Digital Mixer with Wildtracks option from Level Control Systems. Finally, Richard Zvonar, from Level Control Systems, demonstrated the LD-88 Digital Mixer with Wildtracks option and made these comments: "Level Control Systems makes a digital matrix mixer, the LD-88, which is the core component of our modular SuperNova system. Each LD-88 mixer has eight inputs and eight outputs, and there is a digital multichannel bus (128 channels) that allows you to interconnect up to sixteen of these to get 128 ins and outs. The audio inputs and outputs use 20-bit converters and internally the data format is 32-bit floating point at 48 kHz.

"Our WildTracks playback system consists of a SCSI interface card which hooks up to an external hard drive and gives you sixteen tracks of audio playback without sacrificing any of the inputs. Each one of those tracks can be triggered individually, and they all have RAM buffering to provide instant start. You can group the tracks for playback in arbitrary ways, to define an assortment of virtual playback devices on the fly. You could start out with sixteen mono players, then switch to four four-tracks, a three and a five, or whatever you want.

"SuperNova is programmed using our CueStation software, which runs on PowerMac and Intel hardware under the Be operating system. The LD-88 has an embedded automation system, so once a show is programmed, everything is operated from within the mixer itself. That actually allows you to remove the computer, if you want, and just hook up a go button, and run cues.

"We use a cue-based structure, with multiple cue lists. Each cue list contains cues, each cue contains subcues, and the subcues are used to set up such things as bus assignments, input fader levels with timed fades and pan,

EQ and delay of all inputs and outputs, triggering of playback from the hard drive, or control of external devices. Each LD-88 has three serial connectors as well as MIDI in and out, so you can connect to devices that use RS232 or RS422 and use our system as a show control master.

"There are different ways for sequencing of events in time. You can step through a cue list using a go button, or you can trigger cues from time code. Our system will either slave to time code or generate it, and you can freely mix the recalling of cues by time code or manually. You can also recall cues from an external show control system, using MIDI system exclusive messages or program change commands.

"There is also a system for flying sounds around which we call a "SpaceMap." We use "Bus Trajectories," which are dynamic paths that a sound can follow in space. You can build a graphic representation of a multi-channel speaker setup, and then have multiple sounds traversing the space, each in its own path."

WHICH SYSTEM IS BEST?

There is no clear-cut winner among all these different digital audio systems. (Is there ever a clear-cut choice when buying expensive equipment?) However, most readers can agree that with so many options, and with suggested list prices ranging from $149 to $20,400, people faced with buying digital audio systems for theatre sound playback need to do a lot of homework. What are the specific needs of their theatre environment? What is the budget? Will there be more dollars later to expand and/or complete the system? The next section will focus on different types of theatre environments and how they affect specific sound playback strategies.

DIFFERENT OPERATING PROCEDURES

In some performing arts facilities, the sound staff consists of a small number of people who repeatedly use the same equipment over a long period of time. This situation tends to occur in regional theatres, and also in academic graduate and BFA programs specifically oriented to theatre sound. However, in many academic institutions and some professional theatres sound playback equipment is used by many different people, and these users change frequently. Equipment specifiers need to consider the implications of product life-cycles, the learning curve of devices, the storage methods the devices employ, and the need for both backup and redundancy in these systems, particularly as these issues relate to the number of users and amount of time each user will spend with the system.

PRODUCT LIFE-CYCLES

Before you spend thousands of dollars, it's important to know where a product is in its life cycle. Is the equipment brand new and still being "debugged," or is it fully mature and widely adopted? How important is it that your sound system is "state-of-the-art"? And conversely, no one wants to buy something that will be obsolete before they finish paying for it. Different theatres with different budgets, personnel, and operating procedures will want to purchase equipment at different points in the product life cycles. For example, Broadway theatres require the most advanced equipment in order to remain competitive with the quality of sound in other shows, and money is typically available both for initial purchases, and operating expenses. Some theatres may jump in at the "beta testing" or "early adopters" phase. Graduate programs in theatre sound are excellent places for beta testing or early adopting, especially if the academic institution has made a commitment to

Gerriets International, Inc
(b/w) new film
drop rule

Goddard Design
(b/w) new film
drop rule

this type of research and development and the manufacturers support them. On the other hand, smaller theatres with limited resources are better off waiting to adopt new technologies until they have matured.

Budgets affect where to jump in on a product's life-cycle. Theatres that have significant capital improvement budgets every year can afford to become early adopters, because they can not only afford to purchase software updates and hardware improvements, but can afford to trade in older equipment for newer equipment. Theatres that can only afford to invest in sound equipment sporadically, or have no established long range plans for capital improvements may want to buy into a more mature part of a product's life-cycle.

LEARNING CURVE

Sophisticated equipment with loads of features can do things that basic equipment can't. But it takes time to learn how to use it efficiently and to its full advantage. There is not much point in buying something that is so complex that no one in the theatre, or in the academic program, will ever have time to master it. While the teacher would ideally like to expose students to such sophistication, the same teachers are also charged with a responsibility to support the production and the educational needs of the entire theatre department in productions. Teachers in this situation cannot afford to have students spend too much time learning the equipment while the actors, other designers, stagehands, etc., stand around waiting for this education to take place, (e.g., in a technical rehearsal). To prevent such problems, teachers may want to choose playback equipment that has a very quick learning curve, which would allow beginning students opportunities to both learn a little about sound equipment and how to function as part of the collaborative effort of the theatre production.

A similar situation may occur in professional theatres that hire guest artists who must operate the sound playback equipment themselves. Guest designers are usually "under the gun" just to meet the artistic needs of the show, and they have very little extra time, patience, or energy to learn new equipment under such stressful conditions. In most cases, these designers are likely to want to specify and use sound playback equipment with which they are familiar, so the producing theatre may want to keep some of those options in mind when specifying a sound playback system.

What constitutes a steep learning curve? Generally speaking, learning curves increase in direct proportion to the number of features offered by a sound score playback device, and computer based systems tend to offer the most extensive sets of features. Potential users should consider two issues when choosing the number of features desired versus the learning curve involved: first, who will program the device, and second, who will provide the in-house technical support when the device fails.

The person who specifies the equipment for the theatre may need to consider not only the number of shows required for the board operator to comfortably operate the device, but also the number of shows required for the designer/programmer to master the device. If the programmer of the device is a resident sound engineer who will, over a relatively lengthy period of time, become speedy, efficient, and accurate in their programming, then the theatre may be able to reap the benefit of additional features over the long run and decide to invest in devices which employ steeper learning curves. However, if the theatre employs (guest) sound designers who must program the equipment themselves, or, students who will never do more than two or three shows with the device, then the equipment may better serve the interests of the theatre as a whole if features are sacrificed to keep the learning curve low.

Most manufacturers attempt to lessen the steepness of the learning curve by providing an environment for "running" shows that is simple to use and easy to learn. The manufacturers then structure the hierarchy of the product to allow more sophisticated users the ability to delve deeper and deeper into the more extensive feature sets of the device. This may serve as an effective compromise for theatres that have well-trained staff or designers, but novice sound board operators.

Producers must also consider the support structure available to the sound board operator whose only training consists of first level "running" mode for the show. This first level of training will serve admirably until a problem occurs. Unfortunately, the moment there is a problem, support is required from someone who has a much greater knowledge of the device. In order to trouble-shoot a problem during a performance, a sound board operator may still need an understanding of the system that goes beyond the "running level." If the support structure for the theatre includes an experienced staff person that is available at technical rehearsals and performances, then the theatre may gravitate to more features and a steeper learning curve system. However, if the support staff is already stretched very thin, the theatre may be better off choosing a production playback system that has an easier learning curve.

STORAGE METHODS

A second problem that is specifically related to the number of users of a sound playback system involves the responsibility for the care and maintenance of the "show tapes." In the days of ATRs, the show tapes did not reside *within* the tape deck, but were typically securely stored in a cabinet. Often, the responsibility for the show tapes rested with the sound designer until opening night, at which point, the designer left town, and the sound board operator assumed responsibility for the show tapes. This situation has changed considerably with the advent of digital playback options.

Two types of storage devices are commonly used in theatres today: those that internally store cues on a fixed hard disk, and those which store cues on some sort of removable media, such as a MiniDisc, compact disc, JAZ drive, etc. A potential problem for devices that store cues to an internal hard drive is that the responsibility for the care and maintenance of the show tapes may become muddy if the hard drive crashes or other problems develop. This situation can become particularly difficult in rep situations or in sound booths that also double as production studios. In these types of facilities, the same piece of equipment that holds the show tapes for the current production might be pressed into service to prepare the next show, or run another show (e.g., in a rep situation). Regardless of the policies of the theatre, the possibility exists that someone could accidentally erase or damage another person's show tapes.

One solution to the problem might be the implementation of password protected hard drives, show tapes, software files, etc. In such a system, only persons directly related to a show would have access to the files related to the show. However, such a system still does not satisfy the need that all theatres have to protect themselves when disaster strikes.

BACKUP AND REDUNDANCY

Theatre producers need to protect themselves from two potential problems related to sound score playback systems: loss of data (i.e., in the form of show tapes), and equipment failure. Theatre producers may want to address potential loss of data issues through appropriate backup strategies, and equipment failure through appropriate redundancy strategies. Sound system specifiers should consider the strategies they will implement to accomplish both objectives, and the impact those strategies will have on their capital and

operating budgets before investing in specific sound playback options.

In the digital age, theatres may want to insist that all designers or board operators maintain backups of show tapes. However, specifiers of sound equipment should be aware that all backup methods are not alike, as some devices are more readily capable of creating "clones" or exact duplicate backups of the show tapes than others. Specifiers should also consider that the technical rehearsal process in many theatres is a monumental effort to simply get the show mounted, that even though a policy has been implemented for backing up work, an exhausted designer or board operator is not very likely to make timely backups. As Sancho said in *Man of La Mancha*, "whether the pitcher hits the stone or the stone hits the pitcher, it's still going to be bad for the pitcher." If the show tapes are lost on opening night, it really won't make much difference whose fault it is. To help ensure that backups do occur on a regular basis, sound playback system specifiers should look for backup systems that are relatively quick, painless, and can be easily performed after *every* technical rehearsal.

In the digital age, less and less equipment is repairable by the theatre maintenance staff. The broadcast, recording, audio for visual and film industries have all also faced the problem of how to deal with equipment failure in an environment where down-time can be disastrous. Perhaps the most widely adopted strategy is the planning for redundancy in equipment purchases. If a playback deck or hard drive or computer goes down, the technical staff immediately replaces it with a *spare* piece of equipment. In especially critical cases, the spare pieces of equipment are designed right into the equipment racks, and run concurrently with the regular equipment: if the regular equipment fails, the spare piece of equipment is switched into the system either manually by the sound board operator, or, even automatically by the computer system that senses a failure.

Theatre producers may have a hard time justifying the cost of both backup strategies and redundancy until they encounter a catastrophic failure that forces the cancellation of a performance. It's quite possible that just one such catastrophic failure would pay for the entire backup/redundancy strategy. Nevertheless, the responsibility for addressing the strategy that will be implemented using the theatre's sound playback budget lies with the sound playback equipment specifier, and may have an important impact on the sophistication of the playback system that the theatre can afford.

CONCLUSION

If no product exists that is exactly right for every theatre, individual producing organizations may take solace in the possibility that a particular product may exist that meets their specific needs. Once sound equipment specifiers understand the differences between types of devices used in live theatre, and have analyzed the unique needs of their theatres, they will find themselves in a better position to make the best choice possible for their situation. In part II of this article, scheduled for publication in the fall 1998 issue, a wide array of commercially available products are presented, compared and discussed, to help readers collate some of the more commonly employed solutions into a more readily comprehensible form. ❖

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