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Concert Sound Update 16 2072 Ŷ

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For a complete information package, including an audio cassette demonstrating the Synclavier and the Direct-to-Disk System, send \$5.00 to New England Digital Corporation, Box 546, White River Junction, Vermont 05001.



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SERIESTEN "

Dave Harrison is responsible for

conceiving and overseeing the design of the Series Ten. He was elected a Fellow of the Audio Engineering Society for originating the user interface of today's inline mixing desks. Since he did his pioneering work, nearly all major mixing desks have adopted this revolutionary architecture.

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Harrison

Editorial

Industry Communications

By Mel Lambert, Editor

I'm often surprised at the lack of cooperative communication and feedback between manufacturers and users of pro-audio equipment. Despite the fact that many recording, production and live-sound engineers are highly articulate in their view of current and future technologies—and in such a subjective field as audio mixing and processing, how could this not be the case?—I detect that too few manufacturers keep an active eye and ear on the changing demands of our industry.

During the past couple of decades, the infusion of ideas into the manufacturing sector may have been sufficient to ensure that new products and technologies appeared in the hands of sound engineers and producers to match the changing demands of their art. These days, however, the diversification of audio production tasks that need to be handled in recording studios and liveperformance venues is accelerating at such a rate that we are often limited in efficiency and creativity by a lack of access to appropriate tools.

This need not be the case. There are dozens of companies around the world carrying out large amounts of expensive R&D in the fields of digital signal processing, speaker technology, amplifer design, random-access editing, console topography, tape machine control and the myriad sub-divisions of audio electronic and electromechanical design.

I sometimes wonder, however, if the manufacturer's intended design goals are sufficiently aligned to the needs of the potential user. On more than one occasion while wandering the exhibition halls at AES, NAMM, APRS and similar industry gatherings, I have come across some interesting paradoxes. I have received fascinating demos of new or upgraded products that give every appearance of representing a true breakthrough in audio production capability. The same innovations, however, incorporate one or two anomalies that mar an otherwise interesting design approach.

The modern generation of computerbased editing and time code synchronization systems represents one particularly good example of the kind of design anamolies to which I am eluding. Obviously, the majority of such systems can take advantage of the power of the "mighty micro" by being based around a proprietary or lightly customized PC—if only because such systems are available from OEM suppliers at a sufficiently low cost, and offer more than adequate computational capacity. However, where their respective designers of such systems go slightly adrift, I would hazard, is in the area of information displays and operator interface.

The PC usually comes complete with a composite color of monochrome video output, which naturally suggests the use of a conventional CRT monitor. The same PC came out of the box with a standard QWERTY keyboard, so that becomes the natural choice for system control.

So far so good, it could be argued, until you have to address the problem of where to locate the CRT monitor and keyboard within reach of the engineer in a crowded control room. There is seldom space on the console surface for the monitor, so the meter bridge becomes a likely candidate. Provided that the monitor is of sufficient size to be viewed from a distance of about 3 to 4 feet-which might also suggest that the screen graphics need to be extremely clear, and of sufficient size and contrast-and doesn't interfere with the stereo perspective from the main wall monitor loudspeakers, we may be able to get away with it. And, if the keyboard is on a sufficiently long lead, we might be able to find enough space on the console to give it an albeit semi-permanent home near the mix position.

Aside from perhaps integrating the CRT monitor display and keyboard functions within the console's existing automation, recall and transport control system (now there's an idea whose time has most definitely come!), I cannot help but wonder if manufacturers of such devices spend enough time working with engineers and producers, or canvassing their opinions during the initial concept stages.

Of the other oddities I could mention, one immediately springs to mind: miniature display windows on outboard effects units that cannot be read from outside of a narrow viewing angle. And what about complimiters and expanders whose metering cannot be switched to read input and/or output levels as well as gain reduction?

I'm convinced that albeit minor operational features such as these—and we have all come across other examples of the genre—could easily be prevented if we opened up enhanced lines of communication between the talented manufacturer and the talented user. I can think of no better way of honoring our pledge to both sides of the industry than offering to serve as a viable and active communications forum.



REINFORCEMENT: THE NEXT GENERATION



The simple fact is, all the other PA consoles available today lack the processing, monitoring, and routing capabilities that today's touring acts have grown to expect in the studio. The WHEATSTONE MTX-1080 is the reinforcement console that PA mixers have been asking for. It's loaded with features, like programmable muting; 8 effects send controls (each with pre, post and off functions, programmable to pre-fader or pre-EQ); four-band sweepable equalization with switchable Q and peak/shelf modes; tunable HPF; separate electronically balanced mic and line inputs (transformer balanced option available); XLR direct channel outputs; and channel, subgroup and main output insert points. Of course, the console also has eight 11x1 input matrix mixes (up to 16 are available using optional matrix expander modules). Mainframe size, module complement, group placement and aux zone control modules are configured per client specifications.

Now in our 10th Anniversary Year—ten years experience building Audioarts Engineering and Wheatstone custom consoles. The WHEATSTONE MTX-1080 Console: built by professionals... for professionals.



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News

AES sponsors fifth International Conference

The Audio Engineering Society will sponsor the Fifth International Conference on "Music and Digital Technology," May 1-3 in Los Angeles.

The 3-day conference at the Biltmore Hotel will feature session topics on MIDI, computer networks for music, real-time control devices, digital music workstations, music software, composing music on personal computers and the development of the CD-1 format.

Members of the organizing committee include Dominic Milano, editor, *Keyboard Magazine*, Robert Moog, Kurzweil Music Systems, Curtis Roads, editor, *Computer Music Journal* and John Strawn, conference chairman, S Systems.

For more information contact the AES national office at: 212-661-8528.

Gauss duplicating systems for Europe

The following European record and tape companies recently purchased

Gauss series 2400 cassette duplication systems to expand their music tape production: L.J. Music, Hjoerring, Denmark; Kovophon, Prague, Czechoslovakia; Tonstudio Koch, Tyrol, Austria; plus Agfa Gevaert, Munich, Teldec, Nortorf, Record Service Schallplatten, Alsdorf, and Pallas Schallplatten Fabrik, Diepholz, West Germany.

The series 2400 system will duplicate music tapes on ferric, chromium dioxide and metal-particle formulations. Master loop bins operate at up to 480ips, and slaves up to 240ips.

Sales of PD transports reported by Mitsubishi pro-audio group

Since the start of the year, six PDformat X-850 32-tracks have been shipped to U.S. facilities. In Los Angeles, X-850s have been delivered to A&M records, Gear Studios, Ivan Rene Moore Studios and Enterprise Studios. Clinton Studios, New York, and Audio Media Studios, Nashville, TN, have also installed X-850s. The first X-400/8-channel recorder has been shipped to The Burbank Studios, Burbank, CA, for use in the facility's film re-recording stages. Tapes recorded on the 8-channel version of the X-400 ½-inch transport can be played back on the 16-channel transport, Mitsubishi says.

Peirce-Phelps awarded contract for conference center

The Scanticon Corporation has awarded a contract for the company to supply and install audio and video systems at the new \$40 million Scanticon-Minneapolis Executive Conference Center and Hotel, scheduled to open in October 1987.

Conference rooms are sound-proofed and equipped with color TV monitors, display board systems and computer interface. Each center has its own staff of A/V technicians, and TV and graphic arts studio. Peirce-Phelps will equip the master control room, main auditorium and individual conference board and breakout rooms.



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RECORDING ENGINEER/PRODUCER is edited to relate recording science to recording art to recording equipment, as these subjects, and their relationship to one another, may be of value and interest to those working in the field of commercially marketable recordings and live audio presentation. The editorial content includes: descriptions of sound recording techniques, uses of sound recording equipment, audio environment design, audio equipment maintenance, new products.

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BPA Membership applied for December 1986

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-Correction-

Electronic Case Study

A page transposition in Paul Lehrman's article "An Electronic Music Case Study," published in the March issue, may have caused a degree of confusion.

At layout stage, pages 87 and 85 became transposed, with the result that they now run in the following order: page 84 to page 87 to page 86 to page 85 to page 88; the remaining pages are in their correct order.

Our apologies to Paul Lehrman and **RE/P** readers for any confusion that this error has caused—*Mel Lambert, Editor.*

People

New publisher for RE/P

Dennis Milan has been named publisher of **RE/P** and its sister magazine, *Sound & Video Contractor*, in which he will oversee advertising and marketing directions for both titles.

Prior to joining Intertec Publishing, Milan was with a business directory company, and has a 10-year background in various aspects of advertising and marketing.

Harald Bode

Harald Bode died at the age of 77 on January 15, 1987. For over 50 years he had been active in the design of electronic musical instruments. His wife will continue his business as Harald wished.

Of the many products he developed, the Bode Vocoder was probably the one of which most of us in America would be aware. It is still one of only three highquality vocoder designs to exist today.

Harald's quiet manner, and his neverending interest in electronic music are only two of many reasons that he has earned a following.

Only weeks before he died we talked about adding new digital signal processing gear to his private studio. He looked forward to playing with the newest that technology had to offer but, unfortunately, did not get the chance. He was one of the good guys.

An appreciation by Stephen St. Croix. R·E/P

Letters

Cassette duplication

From: Todd R. Lockwood, owner/manager White Crow Audio, Burlington, VT.

I read with interest Kenneth Bacon's article, "Selecting an In-Cassette Duplication System" (February 1987 issue). However, I don't feel he offered enough evidence in favor of using high-end consumer decks for real-time duplication.

We installed 30 Nakamichi BX-1 decks in 1983, and, since that time, have had only three machine failures. This deck is actually a modestly priced machine, at about \$300, but we have been very impressed with its stability. Since Nakamichi is one of the only manufacturers who has strictly adhered to the Philip's standard for cassette playback equalization, we found it necessary to alter the recorded equalization to more closely match the average consumer deck.

Like many consumer decks, the BX-1 has a timer switch located on the front panel which allows the user to activate record mode by simply turning off and then on the ac current. This feature eliminates the need for wiring the transport controls into a common control bus.

As a recording studio, duplication is not our primary service. However, the cassette decks have returned their cost about six times over. The investment is further supported by the fact that we have a ready market for used machines: the public. When the machines are turned over, we replace the heads and pinch roller, and offer a short-term warranty. The decks sell for 65% of their original cost.

We credit Resolution, Inc., in Vermont—the granddaddy of real-time cassette duplicators—with pioneering the idea of using consumer decks for duplication. Resolution's facility currently houses over 160 Revox 215 consumer decks, putting them in a position of being able to handle substantial size orders of realtime cassettes.

For those interested in offering the highest possible quality cassette duplication, my vote is for the high-end consumer deck.

Reply from Kenneth A. Bacon, president of KABA Research and Development, Novato, CA:

Todd Lockwood's letter is a good expansion on my article published in the February issue; space did not allow for very much discussion on specific types of equipment.

Most recording studios have done just as Todd described—used a stack of consumer tape decks for making cassette copies. It takes 30 minutes to copy 30 minutes worth of music but, because it is real-time, use of a good deck will give you a very high quality copy—a characteristic of great importance to recording studios. Efficiency comes by making a number of copies at the same time, in a stack. Many recording studios still use this method. Five years ago, when our own cassette duplication facility here in Northern California wanted to expand from highspeed into doing higher quality music duplication, we purchased a number of high-end consumer decks (actually we tried three different brands). We were very pleased with the sound we were getting, and also the additional revenue that the service brought in.

But then, within months, the decks wore out, and we were informed by the manufacturers that they were just not designed for the use to which we were subjecting them. We tried to find a deck manufacturer who would work with us to develop a more rugged unit, but they all felt the market was too narrow.

The only way to go seemed to be to use consumer decks and replace them periodically—a practice still used extensively. This could still be the best plan for someone with relatively light use.

However, for the production house there is now a much better alternative.

We took the experience we had with real-time and high-speed duplication, and spent two years working with a group of Japanese engineers whose company specialized in motors, and who developed and manufactured continuous play background and foreground music systems. The result is the KABA 4-track real-time and 2X duplication system, which will produce four to eight times the number of cassettes per deck, per day that is possible with consumer decks.

Letters

Using consumer decks does have the advantage that, after their performance is no longer adequate for studio duplication, they can usually be sold to the public as used equipment. Our equipment is dedicated to cassette duplication—both positions in the slave decks are copy-only and the master deck is a system control center with a play-only cassette transport. However, head life is conservatively rated in excess of 2,500 hours, and the transport life expectancy is 10,000 hours—5 years of 8-hour per day operation—which is five to 20 times that of consumer decks.

Since the main purpose of the article was not to recommend any particular type or make of equipment, but rather to suggest things the prospective purchaser should think about during the process of selecting a duplicator, the preceding information and a lot of other very interesting stories and developments in this particular field had to be left out.

Amplifier/loudspeaker connections

From: Neil A. Shaw, Paul S. Veneklasen and Associates, Santa Monica, CA.

Per Bob Hodas' request in his article entitled "Amplifier to Loudspeaker Connections," published in the January 1987 issue of **RE/P**, blue was suggested as the color code for the right channel. May we suggest red as a more appropriate color?

Also, what about 3- and 5-channel stereophonic systems?

From: John W. Schuerman, video production manager. The College of William and Mary in Virginia, Williamsburg, VA. I have just completed reading Bob

Hodas' article "Amplifier to Loudspeaker Connections" in the January 1987 issue of **RE/P**. I am very much in favor of a standardization of commercial loudspeaker connectors, and find the ITT-Cannon units described in his article quite appealing.

However, I would like to suggest one change in the proposal. The "red-light" alliteration for channel designation is so common in most audio applications that I would hate to see it not used for the suggested speaker connectors.

Please pass on to ITT-Cannon that I would like the boot and insulator color for the right channel to be *red* in color.

Thank you for the opportunity to respond to Bob's article, and specifically to this proposal.



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Managing MIDI

By Paul D. Lehrman

Defective and unfinished products have become a way of life in the music software industry, and they are probably the major reasons why many professional studios are still holding back from taking full advantage of computers. Although they can help us do wonderful things we've never been able to do before, everyone that knows computers and software-based devices can also give us headaches the likes of which we've never encountered.

Getting a hardware sequencer to "unfreeze" is very different from dealing with a noisy EQ pot; recovering a file eaten by a program that's crashed makes tracking down even the nastiest ground loop seem like a day at the beach. And most of the time a session cannot continue until a computer failure is straightened out; a computer's downtime is a studio's downtime.

There are a number of reasons why we've come to this point. For one thing, there are numerous new companies making high-tech products for the professional music market. Launching such a company no longer requires hundreds of thousands of dollars for hardware R&D. A couple of guys working in a basement for a few months can come up with a software program that will turn the music industry on its ear just as well as the latest mega-console from a multinational conglomerate.

These companies don't always adhere to the standards we've gotten used to set by larger hardware manufacturers. Many of the people involved are brand new to the field, having come from backgrounds in office automation, graphics or video games, where the demands are very different. They don't really understand the world of engineers and producers who put themselves on the line every day, with \$200-an-hour clocks running. For too many of these companies, if the product works *at all* they're satisfied.

All these new players in the field mean that the market is far more competitive than it's ever been, with the result that speed often takes over from quality as the primary goal. Sometimes a company makes promises it can't keep (programmers tend to be optimistic in their estimates of how long a problem will take to solve) which, come delivery time, puts the marketing department in a bind. The choice is often to go ahead with an

Paul D. Lehrman is a Boston-based free-lance writer, electronic musician, synthesist, producer and regular RE/P contributor. unfinished product, rather than risk losing orders.

The inherent nature of software-based products can encourage manufacturers to be sloppy. Because software is easy to upgrade—you just send out a new disk or ROM chip—a number of companies take the attitude that finishing the product before it ships is not crucial. And, because software is often thought of as somehow less substantial than hardware ("hey, it's just a disk..."), there is more of a tendency to abandon existing products that are giving them trouble before they

Defective and unfinished products have become a way of life in the music software industry.

are really finished, in favor of new, glitzy ones. Of course, in that case the customer gets abandoned as well.

No wonder studio professionals are wary. In fact, with all the bad products out there, I'm amazed that computers have made the inroads they have. I suppose it's a testament of sorts to the enthusiasm and patience of many in our industry, but I don't think that enthusiasm and patience will last too much longer. Products are getting more complex all the time. In too few cases, however, are they getting more solid and reliable. If the manufacturers are serious about growing within our industry, there are certain steps they will have to take.

One step is easy, in theory, although it can be difficult for companies on tight schedules to implement: improve the test procedures. Despite the fact that every manufacturer claims to have a thorough alpha (in-house) and beta (field) testing program, many do not seem to be taking full advantage of them. Certainly if I get a new product, and find a half-dozen fatal bugs after playing with it for a couple of hours—and this happens to me at least once a month—there's something definitely wrong with the maker's testing program.

Manufacturers often say in their own defense that, because products are becoming more and more complex, it is becoming increasingly difficult to predict how they will behave under all possible conditions. This is true, but in some ways it's a copout. With a large enough testing program, all *likely* conditions can be dealt with.

If a product offers a variety of options

in the way it can be used, the creator will invariably have his own favorite approach, which means the others will get short shrift. A dozen beta sites outside the company, each one of which has his own pet way of using the product, can alleviate that problem.

Another solution to the dilemma is simple communication. Listening to customers should be high on a company's list of priorities, but there's another approach: talking to other manufacturers and *their* customers.

On one level, this does take place. At any trade show, much of the activity consists of exhibitors checking each other out. They're doing two things: reassuring themselves that the competition isn't too far ahead: and stealing ideas. As long as it doesn't break any laws, this petty larceny is healthy—it's a form of cooperative development that otherwise would not exist.

But copying the good parts is only half the job. Manufacturers owe it to themselves to learn about what has gone *wrong* with their competitor's products—not just to gloat over, but to learn from. What kind of bugs have surfaced, and how were they eliminated? How do they handle copy-protection, or quantizing notes shorter than the quantization factor, or tape-sync jitter, or MIDI buffer overflow, or operating system anomalies? What kind of improvements have users suggested?

There are various ways to gain access to such information. One is the timetested technique of getting hold of a competitor's product and beating it to death. A second is through public forums, both electronic (like PAN, CompuServe or IMC/Easi) and print ("Letters to the Editor"), where this kind of information is available. A third way is to ask for it. If a manufacturer is successful, it'll be proud of its problem-solving record and be happy to talk about it.

Although it's difficult to conceive of in a society as competitive as ours, a certain amount of cooperation among manufacturers can be of enormous help in producing reliable and stable products. MIDI itself was born of such cooperation. There are now new areas to explore: sequencer file formats, sample formats, timing codes, event lists and other forms of information exchange that can allow one program or device to work well with another.

And, to paraphrase Santayana, those who do not learn from old bugs are doomed to repeat them.

THE EVOLUTION OF SUCCESS

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AND THE BEAT GOES ON

Sound on the Road

By David Scheirman

Today, more than ever before, even smaller regional sound companies are becoming interested in hanging loudspeakers from the ceilings of concert venues, to improve both sightlines and sound coverage for live shows.

Hanging or *flying* sound systems come about through a unique synthesis of audio considerations, visual esthetics plus electrical, mechanical and structural engineering expertise. The hardware that has been developed to fly sound systems has moved in 20 or so years from winch-operated steel cable climbers to heavy iron baskets and stacking decks, to efficient chain motor hoists and cabinets with integral hanging points.

Manufacturers are now beginning to incorporate various types of flying hardware into their product lines. Once the customized domain of major PA companies (who often jealously guarded their "flying" secrets), the current proliferation of commercially available hanging speaker systems makes the ownership and operation of a flying sound system easier than ever before. It also poses some major questions that may concern all touring sound professionals.

High on the list of questions being asked today: Has the flying hardware been checked by a structural engineer, and is it safety certified? Accidents involving hanging gear for concert production systems are fortunately few and far between. If and when they do happen, the results can be catastrophic.

"Whenever anyone raises a question about safety on a hanging project, or is concerned about a particular truss arrangement or piece of hardware, I always defer to them," advises a noted lighting designer, who is often involved in system assembly that uses 30 or more hanging points. "With the risk factor being what it is today, with the everpresent possibility of lawsuit entanglement, it's not worth an argument."

Carrying adequate liability insurance before hanging your first flying system in the air is not only smart, it should perhaps be mandatory. Recent system accidents have had insurance adjusters scrambling for data; whether caused by human error, mechanical failure or an Act of God, any accident will raise many questions in the search for ultimate cause.

In the past, some commercial sound product manufacturers have been hesitant to include hanging attachment David Scheirman is president of Concert Sound Consultants, Julian, CA and RE/P's live-performance consulting editor. points on speaker enclosures, or to offer specific printed instructions. The preference seemed to be to let installation contractors take the plunge (and the risk) in determining how to best suspend speaker cabinets and arrays.

The pro-sound field is perhaps a more dynamic and volatile market; manufacturers competing in that part of the business have embarked on development programs not only for hanging hardware itself, but for manuals and technical papers offering advice in this direction.

Has the flying hardware been checked by a structural engineer, and is it safety certified?

Let's dream up a hypothetical case. (I would certainly hope that the following does not come to pass, but it soon may.) An aggressive new record company puts up tour support funding for an up-andcoming Heavy Metal quartet that specializes in copy versions of Balinese folk songs. Fresh from the nightclub circuit in Alaska, where they have been entertaining unemployed pipeline workers, the band's manager insists that the group's first video should be taped in a concert arena setting complete with a flying sound system.

The international marketing manager for a major speaker manufacturer is an old buddy of the record company A&R vice president; together they concoct a situation whereby the speaker manufacturer will rush its untested hanging system into prototype stage, in exchange for promotional consideration on the video credits.

The sound system goes up, the lights come down, the band hits an opening chord...and the flying arrays collapse, crushing video cameras and tripods, pinning the world class director under speaker cabinets and breaking the guitarist's fingers. The truss-bar welds (which were done at midnight only the night before setup) were faulty, the army-surplus nylon webbing used for cabinet straps was rotten from jungle fungus, and the regional sound company hired to help out had used non-casehardened assembly bolts.

Lawsuits fly like a flock of starlings. The video director sues the sound company. The guitarist sues the manufacturer whose products he was getting ready to endorse. The civic arena who booked the building sues the record company for damages to the hardwood floor and staging. The speaker manufacturer had announced the new flying system at a trade show, so a hasty redesign is made and it hits the market.

A primary question: Does the CEO of the multinational corporation that just successfully bid for purchase of the audio product manufacturer in question *really* want to end up as a deep-pocket target for attempted liability claims?

The film $M^*A^*S^*H$ depicted a pair of army surgeons on a golfing holiday, able to be on the links in the morning and be operating a thousand miles away that afternoon. Such professionals do exist in the touring sound business; the Pros from Lititz (or Dallas, Baltimore, Plattsburgh, NY, Des Plaines, IL, or Canoga Park, CA, etc.) regularly make a living by flying safe loudspeakers arrays.

The hardware systems that have evolved to service the touring sound industry were not created overnight; hanging hardware has moved from cablewinch climbers to iron-framed basket grids to chain-motor hoists and Aeroquip fittings and dedicated flying cabinetry in something under 20 years.

Professional, nationwide touring sound companies may have a vested interest in keeping their flying system information on a proprietary footing; more competition from regional companies and new contenders on the same turf can have economic impact. Some touring-sound industry veterans, independent consultants and structural design engineers are available for flying system design projects; computer modeling is speeding up the system development process. Flying systems are proliferating, even very small ones, for club band touring.

If you or your company are considering hanging loudspeakers in the air for any reason at any time in the future, weigh that decision very carefully. Do not hesitate to spend the time, money and talent it takes to correctly design and safety-test *any* hardware fittings that will be used. It's not something to fear...but something to be safe about.

The system that you may be considering is possibly a premanufactured setup from a manufacturer's product line. Demand product documentation, design certification and be sure to allow sufficient time for system familiarization, before you become party to an accident that endangers life and property. **REP**

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Circle (9) on Rapid Facts Card



Film Sound Today

By Larry Blake

Early last year I had the opportunity to handle extensive production sound recording for a film. Shooting on the 40-minute short (actually the first third of a feature) lasted an initial 10 days, with pickups and reshoots taking place over the next few months.

My partner during most of the shoot, Doug Hemphill, and I decided from the start to split 50/50 the boom operating and production mixing chores. I quickly found out what my scattered production sound experience had only hinted at: boom operating is a much tougher assignment.

This is in contrast to the widely-held belief that the production mixer does all of the work, while the boom operator just holds the mic. I am reminded of an interview with the director Terrence Mallick (*Days of Heaven*), who said that many low-budget filmmakers think they can get their proverbial brother-in-law to hold the boom. While I don't agree with the conclusion that he made — if you can't afford both a good mixer and a good boom operator you would be better off looping (dubbing) the whole film—his point is clear.

Too often on shoestring operations the sound person is told to get one of the crew members who isn't busy during the take to hold the mic. Dangerous thinking indeed. But back to my experience.

The physical act of boom operating is only one reason why I consider it to be such a tough job. You've got to know the script and hope that you get a chance to rehearse your cueing between the actors. Even if you are lucky enough to get a rehearsal, watch out for last-minute lights that the director of photography turns on, causing your elaborate boom move to create an eclipse across the actor's face.

Indeed, one of the more bizarre aspects of production sound recording is that the quality of the track is, in many respects, a function of the assistance you receive from the camera crew and the assistant director.

One of the ways that the director of photography on a 1.85:1 theatrical feature can help is to frame for wide-screen release *only*, and to not protect the TV (1.33:1) safe area. I don't have the space here to fully explain all of this, but suffice it to say that mic position (not to mention set design and camera framing itself) is often compromised because of some time-honored misconceptions.

Larry Blake is RE/P's film sound consulting editor.

I don't want to make it sound as if mixing is a cake walk. Production sound mixers have a pretty tough time with radio mics too, because you must cue between actors standing near each other to avoid acoustic phasing. In addition, the job often becomes real nervewracking when crossfading between radio boom and plant mics.

But enough of my distributing credit among the sound crew; I would just like to see more production mixers share some of the limelight with their boom operators.

I would like to see more production mixers share some of the spotlight with their boom operators.

After the picture had been edited, I had the opportunity to compare on a film synchronizer my virgin tracks to the cleaned-up and split-up tracks that will go to the dub stage. It was interesting to hear how careful placement of room tone, a frame here and a frame there, removed offending noises from the track. It almost made me feel bad that I hadn't solved this problem when it originally occurred.

This experience drove home the point that production sound is *not* an end in and of itself. It is done to serve, first the picture editor, and finally the sound editor whose work goes to the rerecording mixer.

In my February column I offered that it is probably best that production mixers work only on production, and that a rerecording mixer stay on the dubbing stages: experience and specialization breeds quality!

Although this may be true, there is another point to be made. If the production mixer knows that he will have to edit and mix his location tracks later on, human nature would probably lead him to do a better job. In today's *modus operandi* the buck (track?) is passed, with very few production people in Hollywood ever having any sound editing or re-recording experience, much less on films that they work on during production.

Although the same might be said of sound editors and re-recording mixers—they haven't participated in *production*, either—the analogy doesn't fit because they have had to fix scores of problems in production tracks. Even though the film's director, Richard Anderson, is one of the top sound editors in Hollywood, even he, with the sun going down (or coming up, as was often the case), on more than one occasion had to be convinced of the need for recording room tone or wild tracks. (The latter is the reading of lines for sound only, usually moving the mic in a better position and turning off noisemaking devices, like cameras, that had to be on during the shot.)

I don't doubt that many a great dialogue job has been done without the production mixer providing room tone and wild tracks. Dialogue editors and rerecording mixers can work wonders. In my hometown of New Orleans we might call such tracks "lagniappe," a Creole colloquialism that describes the little something extra that merchants would give their customers. Maybe it's tough to convince impatient crews to sit still for these tracks, but this little extra often goes a long way in post production.

For example, during production of *Star Trek IV: The Voyage Home*, fewer than 15 lines had to be looped in the whole film. Mind you, this isn't your soundstage-bound Neil Simon comedy; *Star Trek IV* was a quintessential big budget film laden with special mechanical and optical effects. In this instance though, director Leonard Nimoy took great pains to give the production mixer, Gene Cantamessa, the time to record wild tracks. The log book used to organize the code numbers of picture and sound listed dozens of wild lines that would otherwise have been looped.

All of which brings me to the next important lesson I learned: all the lagniappe in the world is worthless unless it can be found. Clear and complete sound logs and vocal slates are an important, though defintely not glamorous, part of the production sound team's job.

I did learn some things. A 40Hz subtone under the vocal slates *really* does help transfer personnel locate the print takes. If your portable mixer doesn't have this feature, then go into play right after leaving record mode, but before stopping the recorder. Not only will this leave a blank spot between takes, but, because of a lack of sync tone, it will also cause the lock light to go out on the transfer bay's synchronizer.

This discussion of production recording will continue next month with a look at the use of stereo recorders.

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Circle (10) on Rapid Facts Card

Living with Technology

By Stephen St. Croix

l am a firm believer in individuality; I am, in fact, an individual kind of guy. Most people in this industry probably are.

When we were young, our parents tried to teach us that we should function in a way that met certain standards: their standards. As we matured, we held on to the concept that we had to perform to standards, but we found ourselves in a position where it was possible to set our own standards. Most of us did.

Free at last from the constraints of seemingly artificial values, the T-types among us went on to construct their own unique sets of standards. Some of these very same T-types then went on to start the manufacturing companies that design the pro-audio equipment that you use today, still using their own unique sets of standards.

But now it has come full circle and we find that there is a need for all of us to agree and conform to a master set of standards again. Failure to do so means failure; period.

Lack of standardization has been a problem in the professional audio field since its beginning. Differing ways of measuring distortion and noise have made it complicated for the buyer to compare when shopping for hardware. The "pin #3 or #2 hot" double standard for XLR connectors is still with us today, as is the hum that the wrong choice promises. Standards such as dBu, dBm and dBV are still used interchangeably by many. Trick uses of the actual meanings of total dynamic range and signal-tonoise ratio still deceive the occasional customer into expecting a heavily companded machine to stay quiet during flute solos. Surprise.

Failure to establish or adhere to analog electrical standards has made buying a bit confusing, and has always been a rock in the road for those trying to make purchasing decisions. Usually it's an inconvenience, but not a disaster.

If we search our industry's history of mechanical standards, however, we discover clear warnings that, for every standardization battle, there is always at least one total loser, often many losers and only one winner, and sometimes (when the buying public senses enough confusion) no winners at all.

The list of standards that disappeared because of technological advances is almost endless, and must be thought of as merely a part of our industry's growth.

Stephen St. Croix, RE/P's technology developments consulting editor, is president of Lighting Studios and Marshall Electronic, Baltimore. They served us well and generated the market interest that paid for the evolution which eventually took them out. Those of us stuck with 2,000 8-inch floppies (and maybe two or three \$10,000 5-meg Winchesters) have to realize that we helped to finance the 3.5-inch 1Mbyte floppies that we use now.

The list of standards that lost the war, and took customers along as casualties, is a bit more painful for many of us to recall. It includes such gems as videodiscs and 8-track cartridges.

Lack of standardization has been a problem in the professional audio field since its beginning.

Forty years ago, Akio Morita and Masami Ibuka started Sony in a basement. Morita is still chairman, and has obviously made numerous correct decisions in those 40 years. But he admits to at least one bad decision, which he calls his worst business error ever: Beta.

Although Beta is clearly the superior consumer video format in transport mechanics, image resolution and noise, and even cassette size, VHS has taken over as the format of the masses. The collective marketing power of the many companies producing VHS decks has forced this inferior format to be the winner in the video standards war.

Here is a nice little story that should amuse you. Sony invented VHS. It wasn't very good, so they bagged it and tried again. The second try was named Beta. For technical reasons, it made sense to abandon VHS (Video Home System), and continue to try and do it right. For business reasons that nobody seems too sure of, and nobody takes credit for, Sony virtually gave away the abandoned VHS format to the competition, instead of hiding it in the back closet of the lab. Who's sorry now?

Now we're at a point where we can make more of these mistakes in a year than we have in a lifetime. Ongoing format and standards battles today include CD-V, DASH/PD, digital data rates, audio sampling frequencies, error correction schemes, R-DAT format (possibly replay-only), 8mm video and HDTV. And don't forget the battles we've grown so used to that we think of them as part of life: Dolby A, B, C and SR, ANT c4, dbx and all the other analog noise reduction schemes. Amazing. We can't even standardize MIDI sequencer file formats.

And then there are the political moves to assure that the R-DAT format uses some non-44.1kHz sampling rate, so that you can't digital copy a Compact Disc. Anybody should realize that a move like this will merely generate a large potential market for a consumer-targeted sample-rate converter. (I know of people working on that now, just in case.)

If we would grow up and overcome our individual desires to inflict our particular standards on the world, we could actually develop compatibility! The customer says he wants this, and it is clear why. A little compatibility goes a long way. It makes each of his machines potentially more powerful. It means that they have to learn only one basic data or system concept.

The manufacturers say they understand, but secretly they really don't want it in most cases. They often feel that the system they have come up with is superior, and to adapt to a competitor's specs would compromise the performance of their product. In addition, they are often simply not willing to make available the type of detailed technical information needed for companies to get together. Secrets are secrets, after all.

Let us not forget the fact that both customers and manufacturers alike currently believe true standardization and compatibility means that a lower number of actual machines might need to be purchased to get any given job done.

We used to make all of our audio machines talk to each other with analog audio. This forced a standard of sorts, and every machine could at least get data into and out of every other machine, because it was converted to a standard data format for every transfer: analog audio. Sometimes this worked pretty well, and sometimes with considerable degradation; but the signal always got there.

Things are quite different now, and lack of standardization in our new digital world doesn't just cause a little confusion, it simply stops everything from working at all.

Now we are faced with outgrowing the Band-Aid of resorting to use of audio for communication, and we must really standardize. While a slightly mismatched audio interface will still fly, a slightly mismatched digital interface...will crash.



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Circle (11) on Rapid Facts Card

SPARS On-Line

By Gary Helmers

In last month's column we began a discussion of how a recording studio can successfully enter and prosper in the potentially lucrative broadcast production market. We'll continue this month with some advice on acoustics, staffing the studio, billing the client, promotion and cultivating a studio attitude that will work in this highly competitive field.

Studio acoustics, whether good or bad, become glaringly obvious when recording a solo narrator. There are words separated by silence. Some studio owners will say that "no acoustics is good acoustics" when dealing with radio and television production.

It's true that purity of sound is important when dealing with the many levels of audio post-production, but rooms with acoustic character can work to your advantage. Clients will notice and remember the special characteristics of a room—just be sure that you have some flexibility in livening or deadening the acoustics upon request.

One factor is constant in all good production rooms: the air conditioner *must* be as quiet as possible. This seems to be an obvious and minor consideration, but is often overlooked. It can be very embarrassing when your big broadcast client stops the session to ask about the mysterious and annoying drone on the recording.

Plan ahead and you won't have to dismantle your studio to fix the air ducts and isolation. Quiet consoles, digital recording and the starkness of a solo narration demand great care in studio acoustics.

Although selection of the right equipment for your particular needs is crucial to success, a studio's most important asset is the people who operate that equipment. It is vital to attract, educate and maintain a self-motivated, enthusiastic staff. The client expects, and deserves, trained professionals with an attitude conducive to pleasant and productive sessions.

Time very clearly translates as money for advertising and broadcast production clients; they will not tolerate wasted session time. Engineers must be able to achieve the requested sound, record, edit and assemble soundtracks at lightning speed without mistakes. A junior engineer waiting for that magical album session will not do. To attract a professional clientele you need a staff that enjoys serving your advertising and production community.

Gary Helmers is the executive director of SPARS.

In the front office, you need people who understand purchase orders, job numbers and, most of all, deadlines. The person making tape copies must understand that each dub represents thousands of dollars of purchased radio or television broadcast time. If you fail to deliver a flawless dub on time, and the client misses the scheduled air date, you may escape litigation but you won't escape the client's wrath. The client won't understand or care about any excuses.

Again, attitude is all important. Problems are inevitable when dealing with

Scheduling problems and handling last-minute changes for ad production is the supreme juggling act.

the broad range of clients encountered in producing commercials and multi-image projects. The staff must be able to live and work with all sorts of people, and graciously correct any problems that may arise. And, when the next client comes in, the studio must sparkle with fresh enthusiasm.

Scheduling sessions and handling lastminute chages for ad production is the supreme juggling act. The traffic person responsible for handling these duties will need to be familiar with the length of time required for different jobs. This type of work, if you are successful, means a great volume of diverse sessions.

Many production clients will contract their own musicians, actors and actresses. However, you might want to consider providing this service. Working with professionals that you are familiar with has distinct advantages. Many clients appreciate a studio with the capability of hiring the necessary artists for particular types of productions.

Busy advertising agencies also appreciate receiving one invoice for the entire session. They cannot get paid until they submit a bill to their client, and many actors and actresses are quite slow when it comes to invoicing. This additional service can be taken care of for a fee that is added to talent costs.

In short, getting your invoice out the door quickly will help you get paid quickly. Moving invoices quickly brings us to the next topic: getting your money. Basically, if your studio is an important resource for your customers, you will get paid in a reasonable period of time (30 to 45 days). If you don't run a professional operation, or if the studio competition is stiff in your locale, clients will bounce around from studio to studio. Don't be afraid to hold their tapes or even refuse to do a session for lack of payment of past bills. It is difficult to do this if you are just beginning but, it the clients are worth having, they will eventually pay. Additionally, it's entirely acceptable to charge interest on unpaid balances.

For a studio staff used to recording 3minute songs, the transition into 15-, 30and 60-second commercial spots can be confusing. Just how long is a spot anyway? Because of television network scheduling, a TV spot may not exceed its allotted time frame. A 31-second TV commercial will probably have the last second chopped off by the following item.

A good rule of thumb for TV production is 29.5- and 59.5-second soundtracks. Radio is a bit more flexible because of the lack of network regulations and the desire of stations to make the advertiser happy. You can get by with a little more time for radio. Another rule of thumb might be 30.5 and 60.5 as maximum length for spots.

Equip your control room, dubbing room and even the studio with reliable and easily visible timers. Good announcers can shave tenths of a second off a spot it they can see the clock.

So you've built a fine studio, staffed it with the best people you could find, and you're ready to start producing soundtracks. How do you attract agencies, video producers and industrial multiimage accounts?

In every market, major or minor, there are societies and organizations devoted to these businesses. Look for the Society of Communicating Arts, or the advertising club in your locale. Search out the local branch of the Industrial Television Association (ITVA) and the Association of Multi-Image (AMI). Join the organizations and get to know your potential clients. Obtain your area's directory of advertising agencies and find out who's in charge of production at the companies you would like to work with.

Have your suit pressed and go meet people. They'll be glad to know another production facility is there to help them. Subscribe to Ad Age to keep up with who's doing what regionally and nationally.

Once again, I would like to thank Joe Sheets, chief engineer at Alpha Audio in Richmond, VA, for his help in preparing these last two On-Line columns. **REP**

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Circle (12) on Rapid Facts Card

Concert Sound Reinforcement Approaches Maturity

By John Meyer

Recent developments in loudspeaker, amplifier, crossover, equalization, monitoring and console design have resulted in a radical improvement in the quality of live-performance sound.



Picture the typical concert system of the late Sixties and early Seventies, when sound reinforcement was in its anarchic adolescence. Jumbled stacks of folded low-frequency horn enclosures, midrange cabinets and stacked and splayed high-frequency horns obscured sight lines and competed for acoustical dominance.

On-stage monitors, when they were used, were handled by the house mix engineer, working with rudimentary equipment.

Solid-state amplifiers were still a novelty, and active crossovers represented the cutting edge of experimental technologies.

Phase alignment of system electronics and loudspeaker arrays was widely regarded as insignificant.

Cast in the role of pioneers, the men (and, very rarely, women) who were responsible for these systems battled heavy odds to put on a show. The loudspeaker systems—invariably "homebrew" affairs built by people with little or no formal training—were wildly inconsistent. Distortion approaching 100% made it impossible to reproduce an intelligible vocal sound, and equalization was nearly useless. Component failures

For a Luciano Pavarotti concert last September at Madison Square Garden. New York, Meyer Sound supplied MSL-3 cabinets, 650-R2 subwoofers, UPA-1A downfills and stage monitors. Sound designer was Roger Gans of the San Francisco Opera and Jimmy Lock of Decca Records.

John Meyer is president of Meyer Sound Laboratories and a fellow of the AES.

typically ran to 50% or higher each night.

Happily, the technology and practice of sound reinforcement have undergone explosive development during the past decade, and contemporary sound systems are much more sophisticated than their earlier counterparts.

The rise of manufactured loudspeaker systems has brought greatly enhanced consistency and reliability. Modular fullrange cabinets now afford a high degree of dispersion control. Reliable, high power solid-state amplifiers and active equalizer/crossovers are the norm. Stage monitor mixing is a separate and complex task in itself, and concert sound engineers now work with consoles that are as sophisticated as the best recording and production desks.

As a result, the overall quality of concert sound has gradually improved. Moreover, amplified sound has achieved significant acceptance in legitimate theater, and even classical artists—once the most vociferous critics of sound reinforcement—are taking advantage of high quality sound systems to reach larger audiences.

The developments of the past decade have placed at our disposal the means to deliver consistent high-quality sound show after show, with greater efficiency than ever before. We are approaching a new phase in our industry. The major changes that we now must make, in order to prepare for the technological developments of the next decade, are in the areas of attitude and practice.

This article will explore the implications of the current state of the art, and offer some predictions of coming refinements in the practice of professional live-sound production.

Loudspeaker systems

The clear trend in reinforcement loudspeaker design today is toward the so-called "1-box," full-range modular system. Because it offers the greatest flexibility in pattern control and ease of handling, this approach is unlikely to be supplanted in the near future. The integration of active, prealigned equalizing electronics has also gained broad acceptance, chiefly because it simplifies setup and assures both sonic consistency and reliability.

Existing loudspeaker technology also permits vast improvements in measurable performance. As a result of refinements in transducer design, and the careful application of proven engineering principles, total system distortion can be reduced to less than 1% up to full power, with reasonably flat free-field frequency response and controlled dispersion.

Computer-aided testing techniques make 100% production quality control practical, offering the possibility of minimizing field failures while greatly increasing consistency of performance. With high resolution testing, we can identify and eliminate destructive narrow-band resonances. And most audio professionals now recognize the importance of paying close attention to

The Future of Concert Sound

With developments of the past decade, the current generation of sound reinforcement technology is nearing its maturity. Further improvements will only be made through radically new design approaches, requiring major changes in the way that sound systems are operated.

To understand why this is the case, consider the difference between a studio monitoring system and a concert PA. The studio monitor works in a relatively controlled environment. Any open mics are acoustically isolated from the monitors, and the characteristics of the control room are essentially stable.

In such an environment, it is relatively easy to assure that the monitor system is consistently linear. Therefore, the recording or production engineer has a high degree of control. and the results are predictable and repeatable.

By contrast, a concert PA is a complex and dynamic system. The acoustics of the space are affected by temperature, humidity and audience size, and are thus in a constant state of flux. Open microphones abound, and their signals are routed in a number of ways to loudspeaker systems located both in the house and onstage. Because the positions of some microphones inevitably change in the course of the show, their acoustical relationships to the loudspeakers vary.

Finally, gain, equalization and signal processing changes are made continually, at many points in the system, by several different operators.

Centralized processing system

All of these factors interact, and each affects the linearity of the system as a whole. Given the decentralized architecture of contemporary concert reinforcement systems, any attempts that we make to linearize the system—no matter how sophisticated—are invariably compromised to some extent. In order to attain the degree of control and predictability that recording and production engineers enjoy, the system as a whole must be constantly monitored. and adjustments made on an instantaneous basis.

Ultimately, the only solution to this gargantuan task is a centralized, highspeed, real-time digital signal processing system.

Such a system would replace entirely the house and onstage monitor con-

soles, along with the outboard signal processing and routing equipment, and would perform their functions in the digital domain. It would also monitor the performance of the system as a whole on a continuous basis from a number of sampling points in the space, affecting corrections digitally to maintain linearity. The research and development necessary to make this system a reality will occupy much of the next decade.

As concert systems reach this level of sophistication, the work of sound reinforcement will change dramatically, becoming much more highly technical. Sound system operators, in all likelihood, will move out of the hall itself, preferring to work in an isolated environment with greater access to instrumentation. Certainly, they will no longer concern themselves simply with individual channel gains, equalization and so on, but will interact with the system at a higher level—using controls and displays that, presently, we can only guess at.

Creative/technical producer

There will also necessarily be a new position in sound reinforcement: that of creative/technical producer. Individuals in this position will be responsible for many artistic decisions (much as record producers are) and will direct a team of system operators in a manner similar to that of contemporary television producers. The work will require a high degree of musicality, technical knowledge in digital signal processing and acoustics, and-of course-communication skills. The increasing use of sound designers in the theater and in classical reinforcement may be taken as evidence that the position of live sound producer is already emerging.

Clearly, the effect of these changes will be to ennoble the concert sound reinforcement profession as a whole. In the future, the technical staff will be regarded less as simple piano movers, and more as full creative partners in the shaping of events.

Undoubledly, the capabilities of the next generation of concert sound systems will open up new creative possibilities, influencing the music as well. It seems safe to predict that as a result, live performances will continue to be a vital part of the music field well into the future. overall system phase response.

As these developments become more widely accepted and implemented, the sonic differences among loudspeaker systems inevitably will diminish—as the differences in image quality among color television receivers have become relatively subtle. An industry-wide move in this direction (driven by a clear demand in the marketplace) is already well under way, signaling a fundamental shift in attitudes toward loudspeaker design.

One of the oldest debates in sound reinforcement, after all, turns on precisely this question: Should the loudspeakers behave as accurate linear reproducers, or should they distort the signal in a way that is subjectively "pleasing?"

Until recently, the latter attitude has held sway; for example, most of us have heard the assertion that such and such loudspeaker is "no good for rock and roll" (or some other particular musical style). Indeed, many audio professionals have been powerfully attracted to the notion of specific system non-linearities, preferring to talk about loudspeakers in the same way that a violinist might discuss a musical instrument.

Romantic though it may be, that attitude has some major pitfalls. Non-linear systems militate against stylistic pluralism, because they tend to make everything sound the same. Being relatively unresponsive to equalization changes, non-linear loudspeaker systems severely limit the mixing engineer's creative options. Most importantly, however, they're simply going out of style because of changing demand on the part of artists and audiences alike.

The overwhelming acceptance in the consumer marketplace of highly linear sound reproduction systems—for example, Compact Disc players and high quality headphones—is a clear signal to the audio profession. Without a doubt, the future of sound reinforcement lies in linear loudspeaker systems whose performance is objectively verifiable with standard audio test procedures.

Testing and equalization

One could easily argue that the need

A cluster of JBL Concert Series cabinets supplied by Stanal Sound for a recent Neil Diamond date at the St. Paul Civic Center, MN.



for testing is greater in live-sound reinforcement than in any other professional audio application. Particularly in touring concert sound—where systems are continually disassembled, moved and reassembled—the chances for faulty connections, miswiring and component failures are multiplied. Often there is very little time for discovering and correcting problems.

Reinforcement professionals also face a bewildering variety of acoustical environments (most of which are anything but ideal), and have long known that their efforts can be radically affected by hall acoustics. Even if a loudspeaker system measures ruler-flat in free field, because of physical reflections and resonances its frequency and phase response will differ in an enclosed space.

The environment becomes, in reality, a part of the system itself, and has to be regarded as such. Little wonder, then, that onsite testing and equalization is a long-standing practice in reinforcement.

The most prevalent acoustical testing technique in professional audio is thirdoctave analysis, favored for its speed and cost effectiveness. For sound-system equalization, the technique is normally used in conjunction with multiple-band, fixed-frequency equalizers. Because third-octave analysis is a low resolution technique, it offers a kind of built-in curve-smoother, making it easy to observe general trends in a system's frequency response.

Low resolution testing can yield misleading results, however. For example, a third-octave analyzer will not accurately display high-Q peaks or dips in the system's response; these will simply be averaged into the display of the nearest frequency band(s). As a result, a system that appears quite flat on a thirdoctave basis may in fact have significant frequency response aberrations that balance out in the averaging process.

When third-octave analyzers are used with graphic-type equalizers for system equalization, the process can actually *degrade* the system's performance. In trying to correct a frequency response peak, for instance, one might unknowingly introduce a separate, adjacent dip that averages out the peak in the analyzer display—making the response rougher even though it appears, at low resolution, to be smoother.

This is not to denigrate third-octave analysis, however: the data gathered must simply be interpreted correctly, with full knowledge of the limitations in resolution. Such knowledge will lead to proper application of the technique. For example, third-octave analyzers are very useful in checking for consistent polarity among loudspeakers in an array, since

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cancellations are immediately apparent from the display. They can also be used to check addition between drivers through their respective crossover points (if the loudspeaker/crossover system is phase aligned).

Ultimately, hand held third-octave analyzers will largely replace "phase popper" testers in sound reinforcement because they can perform the same functions more elegantly, accurately and reliably while providing more information.

Recent advances in accoustical testing have centered on high resolution techniques, generally employing sine-wave sweeps (usually with a tracking filter) or some implementation of Fact Fourier Transform (FFT). Both methods offer significant benefits in data accuracy, permitfing precise tuning of system characteristics, and both allow display of phase data.

Of the two procedures, many consider FFT analysis to be the technique of choice, chiefly because it is the fastest when high resolution is required. In its most advanced implementation for audio applications, 2-channel FFT analysis permits measurements in the presence of an audience using music or voice as the test signal.

The acoustics or an empty hall differ radically from one with an audience present. Therefore, the importance of this technique in sound reinforcement cannot be overemphasized. (It should be noted that swept sinewave techniques are perfectly acceptable and useful in laboratory situations and, if properly implemented, can offer substantial benefits in the design phase of loudspeaker system development.) Because, by their very nature, FFT techniques clarify the interdependence of amplitude and phase response, the increasing use of FFT analysis is leading the audio profession to a better understanding of the concept of system linearity. It has also stimulated the recent development of complementary amplitude and phase equalization circuitry that is optimally suited to correction of loudspeaker systems in physical spaces.

Vastly superior to graphic-type equalization techniques, such circuitry allows the operator to efficiently generate a precise inverse of the amplitude/phase characteristic of the loudspeaker/room system. When the inverse function is inserted at the system signal input, both the amplitude response and the phase response improve.

The next generation of sound system equalization equipment (already in development) will couple complementary equalization with dual-channel FFT analysis under computer control. This will allow in-concert testing and equalization trimming using multiple instrumentation microphones to sample the hall at several locations. For the immediate future, operating such equipment will constitute a separate job in itself, handled by specially trained technicians.

Stage monitoring

From the beginnings of concert sound reinforcement, the on-stage monitor system has often been considered a poor cousin to the the main house system. Most of us remember the days when the monitor mix was simply a single extra feed from the house mixer. Even today,

The Prism. developed and built by Showco, is designed to operate specifically in an arena environment. It is described as occupying approximately one-third the area of a conventional system and achieves "unparalleled sonic clarity, accuracy and consistency at every seating position." Shown here is a full Prism rig for a recent Genesis concert at the Reunion Arena, Dallas.



many live-sound engineers regard the monitors as one place where they can compromise on quality, in order to free up money for other uses.

The situation has been complicated by the fact that the monitor system is the most direct contact point between the sound crew and the on-stage musicians. In the past, most musicians have been far less technically minded and more inclined to express their needs in intuitive terms.

Working in an environment of high sound pressure levels, vocalists in particular sometimes have favored a fair amount of intermodulation distortion in the monitors, having learned to use such distortion to determine whether a harmony part is in tune. And, because one wants to satisfy the artists at all costs—in order to remain employed—The temptation exists to seek certain specific types of non-linearities in monitor systems.

Until relatively recently, these factors have combined to hold down the quality of monitor systems. The same forces that are driving main PA systems toward linearity, however, are now also affecting monitors. As the sound quality of concert main systems has become cleaner, the contribution of the monitors to the sound in the house has become more obvious. Audiences no longer tolerate concerts that are plagued by continuous feedback.

And artists, now more technically sophisticated and accustomed to clean monitoring because of their increased recording studio experience, are demanding better stage monitor systems. The technology necessary to satisfy these demands has existed for some time, and is now seeing wider use.

As stage monitor engineers are increasingly seen to be full partners in a total sound reinforcement picture, the same technical advances that apply to the main system will also be employed in the monitor system. For example, the process of "ringing out" the monitors with graphic-type equalizers will gradually be replaced by high resolution measurement and complementary equalization. This will allow higher gain before feedback and will result in much better sound quality-both onstage and in the house. The inherent complexity of monitoring systems and the need for efficient testing will help in turn to spur the development of more intelligent, flexible and user-friendly analysis equipment.

In the long run, it seems inevitable that we will come to view the monitor system as a fully integrated component of a single, larger system that includes the main PA. This is as it should be, since the two are not really functionally separate—any changes in gain or



For the recent World Disco Mixing Championships held at the Royal Albert Hall, London, in early March, Turbosound provided a flown central cluster array comprised of 42 TSE-II mid/high cabinets and 12 TSE-118 bass enclosures. Stage-level units consisted of four TSW-124 sub-bass cabinets, six TMS-4 full-range cabinets and six TMW-212 on-stage monitors. The system is said to have been installed and removed within 18 hours.

equalization at the monitor level also affect the house system.

Technical and logistical solutions will consequently have to be developed to attain efficient global optimization of system performance, while simultaneously allowing the flexibility and control necessary to provide performers with the monitor mixes they require.

House mix position

The increasing use of linear systems has powerful implications for concert sound engineers. Just as Compact Discs highlight the sonic differences between various recordings, so linear reinforcement systems tend to strikingly reveal the differences among various mixing styles. For this reason, the responsibility for subjective sound quality is shifting away from the loudspeakers and toward the input signal, where it rightly belongs.

Many live-performance mixing engineers are still learning to adjust to this concept. As concert sound systems continue to improve, however, attitudes will change. Once we fully accept the concept of linear sound reproduction, we open ourselves to dramatically broader creative possibilities.

In order to fully exploit the capabilities

offered by improved systems, concert sound engineers will inevitably make increasing use of the same tools used in studio recording. The sonic differences among various limiters and equalizers, for example, will assume greater importance; in fact, outboard processing in general will play an ever-widening role in concet sound, and mixes will become more and more complex.

Ultimately, the goal will not be to simply equal the sonic complexity and clarity of studio recordings, but to provide the audience with a sonic experience that surpasses that of recorded music in scale, dramatic impact and immediacy.

Obviously, all of this will make the mix engineer's job more demanding, because he or she will still have to contend with the inevitable pressures of live production. Recording engineers at least have the luxury of taking their time, reconsidering and fine tuning a track or final mix. In live sound, however, there are no retakes. Consequently, concert reinforcement engineers will need to be able to preplan their use of effects to some extent, while retaining the flexibility that concert work requires.

Therein lies one of the greatest potential benefits of current advances in sound system testing and equalization. Coupled with in-concert measurement (using the program as source material), complementary equalization assures an unprecedented degree of consistency in sound system behavior. Because the technique acts to linearize the entire loudspeaker/room system, it effectively erases the local acoustics to a controllable extent, and even permits imposition of an "ideal" (arbitrary) acoustic signature in its place.

Given that one can thus idealize the acoustics of even the most reverberant venue, it becomes possible to standardize processing and console settings, to the extent that very sophisticated mixes are practical. In all likelihood, we will see snapshot-style console automation come to be used in concert reinforcement in the foreseeable future (dependent upon the music's stylistic requirements). Add the potential for MIDI-based automation of signal processor parameters—synchronized with the console automation system—and the creative possiblities become truly staggering.

Concert engineers who keep themselves abreast of these developments, and help to demonstrate effective use, face a bright future.

Designing and Packaging Equipment for Use in Touring Sound Systems

By David Scheirman

What are the pros and cons of custom designing a concert sound system, vs. assembling it from commercially available units, and how best can the resultant system be packaged to withstand a rough life on the road as part of a touring rig?

:::

S ound companies today are better prepared than ever before to put a system out on the road. The hardware and techniques that have been collectively and innovatively developed by the touring industry are making sound systems for portable use safer, more reliable and, inevitably, more expensive.

Manufacturers of professional sound equipment have become more market responsive to the needs of the touring industry. It is now possible to specify offthe-shelf products when assembling a new concert system, with nearly every item available from microphone cables to modular speaker cabinets with flying

David Schelrman is the president of Concert Sound Consultants, and **RE/P's** live performance consulting editor.

points and dollies.

One of the most often overlooked subjects, however, is that of hidden costs. Protective racks and cases, custom power distribution and multipair cabling systems, and the price of shop labor for custom assembly and modification of commercial products—all these factors add a significant sum to the price of any touring sound system assembly project.

For this reason, the actual purchase price of commercially available compooents is often only half the cost of assembly for one of today's concert sound systems. Even non-touring systems planned by regional companies should be carefully cost-projected to ensure that the system assembly project will fit within the budget.

A primary question any business man-

ager or financial backer should ask is: Why is the sound system being built? Is it a hobby effort? Do preguaranteed contracts to recover the initial investment exist? Or, is the system being assembled purely on speculative terms?

A determination should be made as to whether the new system will be just that: a *system*, with the entire signal path carefully examined, or a collection of parts that change from time to time, depending on user need and component availability. If a high-performance, competitive system is required, then there will be plenty of gaps that are not filled by available hardware or at least hardware that doesn't fall within the budget.

Typically, the more money that's spent on equipment to increase a sound system's flexibility for a variety of potential

Why your next console should be as difficult to hear as it is easy to operate.

The studio is more complex and less forgiving.

Electronic production techniques using MIDI and SMPTE sync require more control than a "wire with gain" can provide. But as functions and components accumulate, the console's signal path has grown more complex, and its audio performance has suffered. On analog recordings, higher levels of crosstalk, noise and intermodulation were an acceptable price for additional control. On digital multitrack, however, these flaws become glaringly obvious.

Crosstalk blurs the stereo image.

Now that digital recorders have virtually eliminated crosstalk, this is an especially annoying problem. *The AMR 24 matches the channel separation performance of digital multitracks* because it employs balanced buses that eliminate crosstalk the same way mic inputs do. This radical design approach takes full advantage of digital's more coherent stereo imaging.

Balanced buses also eliminate the intermodulation that plagues the sound of conventional "virtual ground" mix amps. The AMR 24's noise floor is constant whether you route one input to a group, or thirty six. So you can concentrate on the music without distractions from the mixer, even on digital multitrack.

Features shouldn't degrade audio performance.

Automation widens creative possibilities — and narrows the margin for console error. For example, FET mute switches that are "silent" individually can produce audible glitches when grouped. The AMR 24's carefully controlled switching time constants eliminate this problem.

Every circuit in the AMR 24 has been calculated with equally close attention. Each stage has at least 22 dB of headroom; total dynamic range is over 100 dB. Even so, *unused stages are bypassed to produce the shortest effective signal path in every operating mode*.

Perhaps the AMR 24 is a product of extremist engineering. But as we see it, optimum audio performance, not simply a revised layout, is what makes a console automation - and digital-ready.

The feel is familiar, the functions are unprecedented.

The AMR 24 facilitates innovative production techniques within a classically

split configuration. Master Input Status switches select mic inputs or line returns on all input channels simultaneously. In its mixdown configuration, the AMR 24 will handle up to 60 tracks, because the 24 Track Select switch changes the monitor returns to line returns normalled to your second 24 track (or to synchronised "virtual tracks" from synthesisers and samplers). The monitor returns have aux buses, solo and mute, plus four bands of EQ and long throw faders, so this flexibility is achieved with no loss of audio quality. For additional effects returns, the Fader Reverse function creates an additional 24 patch points through the cue send faders.

Imaginative design and uncompromising construction give the AMR 24 flexibility and sonic transparency that represent clear achievements: especially clear on digital recordings. For all the facts on this innovative console, send your business card or letterhead to:



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Figure 1. Increasing system complexity requires a corresponding increase in capital investment.

users, the greater will be the scope of services that can be offered by a sound company. Custom patchbays, splitter panels and snake systems can mean the difference between amateur and professional, when users compare one system with another.

In today's marketplace, it will take a sizeable investment to assemble a competitive concert sound system from scratch. Those major concert sound companies that dominate the touring indus-

Figure 2. A custom-built, proprietary sound system requires a greater investment in labor, compared to parts and materials, than a system assembled from commercially available components. try are able to do so by constantly, but gradually, changing and recycling basic hardware components. For this reason, a catch-up attempt by newer, smaller companies has a limited chance of success within the boundaries of standard business practices.

Figure 1 details this concept. The more available hardware that a sound company has access to, the wider is its range of potential profit-generating operations, The dollar amounts shown here are approximate, and will vary with system application and complexity. In an economic climate where one pair of house and monitor consoles costs more than \$100,000, it is not difficult to understand why those companies that already have their basic system packages assembled and paid for are able to batten down the hatches and come out on top whenever the angry winds of cost-cutting and bidding wars blow.

System assembly choices

The primary cost of assembling a concert sound system and preparing it for the road can either be in the realm of labor, or in parts and materials. Both are required of course; the question is to decide the best direction for a company to concentrate its cash resources.

Figure 3. Labor costs to complete a system made up primarily of available components will be lower; the parts cost will rise.



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Figure 2 shows that in a completely custom-built sound system (in-house manufacturing of consoles, amplifiers, speaker cabinets, etc.). the costs are weighted toward labor for design and assembly of system components. Custom buildups take more time than using commercially available products, and the labor required is more specialized (and more costly).

Figure 3 details the reverse situation. For a system that has been assembled completely from manufactured, commercial products, the cost of system assembly will be weighted toward parts and materials—in this case toward compo-

Figure 4. An expensive mixing console requires a sturdy, foam-lined case for protection on the road.

nents that arrive in cardboard boxes by freight shipment, ready to plug in and turn on.

Todays' new sound systems are usually a compromise. No major sound company in this country today is building everything from console to amplifier, to loudspeaker, for its own use. There are some smaller companies that do specialize in custom systems, including audio gear assembled by an in-house electrical engineer (often the sole proprietor). However, even the largest of companies have moved toward relying on manufacturers for the basic building blocks in a system, particularly in the field of electronics packaging and raw speaker components.

Current trend

In response to the increased need for higher-quality portable concert sound

Figure 5. Custom modifications and additions are made by major sound companies to even the most full-featured commercial consoles. Seen here is Showco's add-on subgroup and cue bus bargraph metering system for the Harrison HM-5, as used on tour with Bob Seger and the Silver Bullet Band.



systems, and to heavy marketing pressures from some pro-sound manufacturers that attempt to increase their market shares, many new touring sound systems have recently been assembled in the United States.

While some sound companies do specialize in custom-built crossovers, or have access to an in-house, self-supporting woodshop, most companies today that serve the sound system rental market are relying heavily on commercially available products.

Because buying the components is just the first step in the process of assembling the roadworthy, contemporary system, let's take a closer look at how such equipment is prepared, modified and protected for use on the road.

Mixing consoles

Consoles represent one of the first and most important investments to be made for many sound companies. The more popular models are easily rented even if a full system is not required; resale value is high for properly selected commercial products. Over a period of years, custombuilt devices do not hold their value quite as well.

The development of a custom-built board is a complex and time consuming undertaking. For this reason most companies conduct a thorough search for commercial products that offer desired features at an affordable price.

The preparation and possible modification of these commecial units is an added cost factor; the improvement of grounding buses, the lowering of circuit noise through chip upgrades, and the incorporation of multipair snake connectors or special patchbays all require shop labor above the original purchase price.

Protecting the consoles on the road with sturdy cases is also a consideration. A case from stock to fit a standard board, such as a Soundcraft 800B-32, may cost \$600; a custom-fit, precision-made case complete with welded aluminum dolly frame for a one-of-a-kind 48-channel desk may come in at \$1,800. Foam lining, sturdy castors and handles help protect the console investment during transport, and facilitate setup and teardown (Figure 4).

Additional features often considered necessary include a spare power supply; miniature gooseneck lamps and even specialized custom units such as external metering systems to improve signal-monitoring capabilities (Figure 5).

Ancillary support systems for a live event can boost the price of system assembly and will include intercoms; wireless communicators are often must-have items at large outdoor and arena events. Hard-wired production-line type inter-

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- **1976** Forsythe SR109, the world's first cone mid range horn utilizing a phasing plug and lead reinforced fiberglass construction.
- **1977** Forsythe B212CT, using polyurethane filled subassemblies to create the world's most mathematically correct bass horn.
- **1978** EAW MR102, the first mid bass horn to use a center displacement plug for flat power response.
- **1978** EAW/Carlo CS3, the world's first "One Box" horn loaded flying system.
- **1979** EAW BH800, the first bent horn using polyurethane reinforced wood construction.
- **1981** EAW JF500, the world's first all horn loaded compact full range system.
- **1983** EAW KF550, the world standard "One Box" flying system with flying strip hardware enabling easy construction of complex arrays with only two fly points per cabinet.

Since then we have continually refined the KF550 to stay well ahead of our imitators. The new KF550C version adds the H9040 constant coverage high frequency horn, full frontal coverage vinyl coated perforated steel grills and rear panel cable/connector chamber as standard. This is in addition to the standard features and performance that has made the KF550 the first choice of sound companies in the past.

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Figure 6. Intercom systems for communication between console locations are another hidden cost when assembling a new system.

com units are typically required at least for each console location (Figure 6).

Microphones, stands and cabling

When a system is being prepared for serious road use, the actual purchase of microphones is just the beginning. A dedicated travel case for the microphone complement is often combined with spare parts and tool storage. A wide variety of stands to enable the prompt response to changing stage needs at different events will include tripods, adjustable booms and goosenecks (Figure 7).

Quick-release clips allow the daily removal of mic holders from the stands to prevent damage in transit, and to speed up stage preparation and load-out time. A typical arena sound system with 50 or so microphone stands may require an investment of up to \$400 (at \$8 each) for these small but useful accessories.

In years past, the assembly of microphone cables, stage subsnakes, six-packs, and even multipair main snake systems entailed many hours of pretour labor. Labor at that time was less expensive than the purchase of expensive commercial cable products, and the configurations required by touring systems were often unavailable.

Today, there are a variety of manufacturing and marketing companies that offer standard and custom premade cabling products. The quick assembly of cabling systems with minimum shop build-up time is as simple as a telephone call and a purchase order.

Three- and 4-way splitter panels with ground-lift switches and military disconnects delivered to specification within a week or two by freight? Only 10 years

Figure 7. Today's concert stages have changing requirements for microphone stands; a wide variety of booms, stands and assorted parts will be carried by well-equipped sound companies.



ago it was just a fond wish. A rapidly growing pro-sound market has helped to inspire the creation of these custom-cable providers.

Electronic equipment racks

Early concert sound companies created and assembled their own electronic crossovers, limiters and even power amplifiers. Specialty items such as line drivers were unavailable elsewhere. Items from the hi-fi recording and broadcast fields were borrowed, with basic modifications being required.

Modern sound systems undergoing initial cost projections prior to assembly include commercially available items that did not exist even a decade ago. Fiveway modular crossover with time correction and phase trim? Channel-insertable noise gates? Ac power-line conditioner and voltage monitor? No problem.

Just make sure to thoroughly check the specification sheets prior to ordering; put the unit through its paces on the test bench prior to trusting it in a live show situation; and, before committing to the purchase of multiple units, verify that your crews give it a thumbs-up over a period of time.

Standard EIA rack-mounting provisions are made by most manufacturers dedicated to the pro-sound industry. Optional plug-in transformers are available from a host of crossover, amplifier and equalizer manufacturers. These items can be a quick fix when the electronics rack assembly starts turning into a humchasing project. (Input and output signal isolation by transformer is usually required if a piece of equipment does not offer power transformer isolation from the chassis, and is mounted in a rack with other gear.)

In examining commercial units for potential use in a professional system, observe how well the device will fit into a buildingblock concept of rack assembly. Is it deeper than the racks that are available for mounting? Are the inputs and outputs balanced or unbalanced, and how will that affect your existing system signal path?

Is pin 2 hot, or pin 3, and how will that affect your wiring harness? Does the electronic crossover under consideration have enough output drive to make it through 200 feet of output snake without an additional line-driver gain stage? (If not, locate it in the amplifier rack, or find another device.)

The proper selection of components that match each other both mechanically and electrically will save countless hours of troubleshooting and modification time. Paying attention to visual appearance can be an important consideration as well. Properly mounted electronic de-
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ohm each leg. Compatible with 25V and 70V systems. 19°Wx 3.5°H x11.56°D SPECIFICATIONS: CARVER PM-350 Power: 8 ohms, 350 w/channel 20-20kHz both channels driven with no more than 0.5% THD 4 ohms, 450 w/channel 20-20kHz both channels driven with no more than 0.5% THD 2 ohms 450 w/channel 20-20kHz both channels driven with no more than 0.5% thD 2 ohms 450 w/channel 20-20kHz both channels driven with no more than 0.5% THD. Bridging: 900 watts into 8 ohms. 750 watts into 16 ohms. THD-less than 0.5% at any power level from 20 mW to clipping. 1M Distortion less than 0.1% SMPTE. Frequency Bandwidth 5Hz 80kHz, Gain: 31 dB. Input Sensitivity 1.5 V rms. Damping: 200 at 1kHz. Slew rate: 25V/micro second. Noise: Better than 115 dB below 350 watts, A-weighted. Inputs. Balanced to ground. XLR or TRS phone jacks. Input Impedance: 15k ohm each feg. Compatible with 25V and 70V systems. 19°Wx3.5°Hx11.56°D

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Each PM-175 and PM-350 has an internal circuit card bay which accepts Carver's new plug-in signal process-



Figure 8. Neat, professional rack buildups will both protect electronic components, and make system operation easier.

vices will be both protected and neat (Figure 8).

A consistent method of mounting units in the racks is desirable. Custom wiring harnesses, cable ties to reduce clutter and an adequate, integral ac supply for the rack all require both planning and shop labor. Extras such as front and rear panel work lamps, ground-fault test indicators and ground-lift test indicators, ground-lift switch, and a compartment for spare fuses and patch cables add increased utility at extra cost.

Some experienced sound companies, after minor trucking catastrophies, equip even small half-racks with metalwork that provides rear support of each device in the rack. Other, simpler options can include wooden framing with shelf supports; duct tape and a strip of 2' x4' lumber has been used more than once in a pinch.

Protective cases

A fully prepared and loaded electronics or power amplifier rack represents a considerable investment in both time and expense for materials. In some cases, the cost of the completed rack, with its custom patchbay, ac, distribution strips and internal wire harnesses can rival, or exceed, the cost of the units it is designed to hold and service.

Custom-fitted, foam-lined cases will be required if the rack is to survive being taken from the build-up shop into the real world of concert use. This represents yet another added cost to system assembly, whether commercial products or custom-fabricated devices are used

Figure 9. Protective road cases for delicate audio equipment are available from a variety of manufacturers. Racks do not survive long on the road without them.



(Figure 9).

Some companies fabricate extremely well-protected equipment racks with sturdy welded metal frames, hinged sideaccess panels for quick re-wiring or unit swapping, and quick-release protective front and rear plates. By the time a company's rack technology has progressed to this level, the rack and its case will probably be unavailable on the open market. Such hardware is built to last a decade or more.

Power amplifiers

Twenty years ago, it was not uncommon to see tube-type power amplifiers carried into a venue wrapped in a moving blanket; available commercial units were intended for use in fixed installations, and the engineering time was spent primarily on heat dissipation and unit survival, with a secondary focus on audio quality and electromechanical integrity.

The advent of solid-state amplifiers made quite a difference in portable system design and operation. As systems became more powerful, sound companies began to add extra bracing and rackmounted ears for popular units from a variety of companies. One or two companies brought out early products with integral cooling systems and rack-mountable cases; today a wide selection of powerful, reliable power amplifiers are available.

Modern power amplifiers are designed for tight stacking in racks; variable input attenuators and signal monitoring devices are standard features. As amplifier manufacturers have responded well to pro-sound market needs, it is extremely uncommon to find custom-built power units assembled in quantity by an eccentric sound company for concert touring use. Major concert sound companies also work in conjunction with amp manufacturers to develop units that will suit their needs. Today, few modifications are required for even the most demanding tour situations.

Power distribution systems

The subject of electrical power distribution is crucial in live sound system assembly, yet commercially available systems that are compatible with concert touring are rare. As lighting and electrical supply companies develop spin-off technologies, some units are available on a custom-order basis.

A simple 100A service with 50 feet of feeder cable for use in a rental stage monitor system can be assembled from less than \$200 worth of UL-approved parts available from an electrical wholesaler; a custom-built 400A distribution system for arena use with subpanel breaker boxes and motorized regulators



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Figure 10. Even well-equipped, commercially available modular loudspeaker enclosures are often modified by major sound companies. Here, a brace of Meyer MSL-3s has been covered with protective Ozite carpet for increasing box life.

for stabilizing voltage levels can break the \$10,000 barrier. The correct assessment of electrical power needs prior to fabrication is an important aspect of system assembly cost projections.

If there is any doubt whatsoever within your organization's staff regarding parts choice and wiring practices, consult with a qualified engineer. An improperly designed or poorly maintained power distribution system can be a danger to your own equipment and to human life.

Speaker systems

There is perhaps no part of a sound system that can present a greater dilemma to a sound company anticipating the assembly of a new touring system than the loudspeaker enclosures. It is often tempting to build from scratch, particularly for newer, younger companies. For the cost of a few sheets of plywood and the raw speaker components, a functioning system can be had at great savings. (A single contemporary modular speaker cabinet from a reputable manufacturer can cost more than \$4,000).

The cost of handles, connectors and castors or dollies to make the enclosures roadworthy, adds to the build-up cost. More sophisticated treatments, like protective carpeting or integral hanging points, will turn the inexpensive plywood box into a serious capital investment. Often, it is not until the new cabinets have been manufactured in quantity, painted and trucked to a show site, that the developing company will get adequate information about performance characteristics of the new devices.

Figure 11. A pair of Meyer UPA-1A loudspeaker enclosures are suspended from two points on a custom-engineered bar, designed for use in a room divider ceiling track for ballrooms and convention centers.



For this reason, even major sound companies will purchase commercially available modular enclosures for evaluation; first perhaps as sidefill monitors and, if the devices pass the test, then in quantity for full system use. Even then, some companies modify the boxes to suit their particular needs (Figure 10).

Hanging system needs will increase any sound system's complexity. Once the realm of major touring sound firms, today even speaker manufacturers are experimenting with hanging hardware, and adding it to their loudspeaker system product lines. Although such systems may seem to offer a quick and easy answer to the question of "how to get it in the air," a thorough knowledge of the hardware intended for hanging use and rigorous safety procedures are firm requirements for *any* sound company owner considering such techniques.

The actual cost of hanging gear will depend upon the rigging arrangement chosen, and whether or not the chain motors required will be purchased as a capital investment, or rented as needed. A one-point hanging system for use with small enclosures is easily assembled with hardware store items, and can be a problem-solver for overhead monitors or fill speakers in a ballroom situation. However, for even such simple hanging projects, sound companies will typically perform stress-testing of components and receive design certification from a structural engineer (Figure 11).

Extra costs involved with hanging system development can include extra length loudspeaker cable harnesses, an additional power distribution system for chain motor operation, and an assortment of nylon straps, steel cable bridles and safety harnesses for riggers.

When planning a concert sound system, keep these points in mind:

• When budgeting costs, don't forget to include the hidden expenses.

• Carefully survey the available commercial hardware before committing research and development funds to custom-made projects.

• Standardized systems are in. They can save both time and money in the long run.

• Whenever possible, use traditional, accepted engineering standards and electrical assembly guidelines for system fabrication. Customized systems may be initially appealing, but once you build it, you'll be using it for a long time—they have an inherently low resale value.

• Above all, can the market bear your system's entry into a highly competitive field, and will you ever recover your investment if your venture becomes unprofitable?



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Eighties Sound on the Road

By Steve Zelenka

Transforming Air Supply's traditional acoustic live-performance sound to one that emphasizes drums and electronic keyboards required the extensive use of studio techniques and signal processing.

A live concert can be an enrapturing experience. Be it rock, classical, reggae or any other musical genre, the ability to enjoy an artist's live sound has become a necessity in today's entertainment arena. As a result, the live-sound engineer's role is becoming more and more important

Steve "Zoomie" Zelenka has handled studio production and live-sound mixing for The Who, Rod Stewart, Bob Marley, Duran Duran, Air Supply and, most recently, Jermaine Jackson and David & David. for replicating an artist's unique sound in live performance. Today's concert audiences expect a closer album-type sound than they did only half a decade ago.

An engineer should become an integral part of the band's sound—be it for live or studio work—while keeping defined the distinct roles of a live-performance vs. production engineer. The advantage in being a live-sound engineer is that you can go into a studio and handle just about anything. When you're mixing live, everything is coming at you. You blink and you've missed your cue; it's history—you're on to the next song. Working in the studio you have the luxury of rolling back the tape to the track and hearing it again.

I recently completed a 90-city international tour with Air Supply, covering all types of venues throughout the United States, Australia, Japan, Hong Kong and

Air Supply in concert at Costa Mesa Amphitheater in Costa Mesa, CA.



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Three Midas PRO4A consoles handled front-of-house sound mixing duties for the Air Supply tour. Of the 60 available inputs, 47 connected to stage instruments and DI sources, with 13 channels being reserved for effects returns.

the Near East. When I started working with the band in 1982, as an independent live-sound engineer/producer, Air Supply was moving to a more "electronic" sound. Before then, their sound was mixed in a safe way; vocals, piano and snare drum were up front and everything else was pretty much forgotten, even solos.

I felt that there are a lot more facets involved in the band's music. I wanted to bring out the drums by adding some artificial reverb and making them sound fuller. I also now try and mix the band's new keyboards into the overall sound. Generally, I wanted to make the band sound a lot more progressive and full.

To define this newer and more contemporary Air Supply sound, I started supplementing the band's existing acoustic drum sound with electronic percussion. They are now using a Linn LM-1 drum-machine trigger system and, on some songs, backing tapes from a TEAC A3440 ¼-inch 4-track (a technique I learned while working with The Who on songs such as "Baba O'Riley" and "Won't Get Fooled Again").

I also began to emphasize guitarist Wally Stocker's heavier chords, although the band's management was a bit concerned about the older crowd not liking a thicker sound. Most of the main band equipment is kept down on stage, but I used an Eventide Harmonizer to make the guitar sound larger in the house, and a pair of gated AKG D12s in stereo on two Dean Markley back-line amps to produce a thicker, wider guitar sound.

We also had synthesizer parts pro-

30-input Midas console handled on-stage mixing.



grammed in two Yamaha DX-7s, which are connected via MIDI through a Memorymoog and Roland Jupiter 8. This keyboard configuration provided strings, horns and electronic effects for up-tempo numbers.

I used a different Lexicon 224X program on each song, including inversed snare, chorus/echo and echo plate. I also used a 224 for backing vocals, and a Lexicon model 200 for lead vocals, sometimes with a reverse-echo setting.

The only Lexicon unit I leave operating all the time is the Prime Time. I program a stereo setting with a 3-second delay to provide a wide image.

Concert example with Air Supply

For a recent Air Supply concert at the Costa Mesa Amphitheater, CA, Tasco provided the PA hardware as they did for the whole tour. Although each night had been set up with subtle differences, the following breakdown is typical of how I mixed the band's sound.

From the house-mix position, 1 used three Midas Pro4A boards of varied configurations. Of the 60 available input channels, 13 channels were reserved for effects returns. Routing of those 60 channels was through eight subgroups to the house system:

- 1) Kick, snare and high-hat.
- 2) and 3) Stereo toms and overhead cymbals.
- 4) and 5) Stereo keyboards.
- 6) and 7) Bass, acoustic and rhythm guitars.
- 8) Vocals.

The first 15-input Midas board was used solely for mixing drums. The last imput channel was dedicated to the return from a dbx model 500 Subharmonic Synthesizer that handled bass drum, Linn bass output and snare top via an effects send. Although no longer manufactured, the 2-channel model 500 operates in the 54Hz-100Hz range and features two control knobs: the first boosts overall low frequencies a maximum of 12dB; the second know control-a subharmonic level-samples the input frequencies, divides that range in half, then outputs a signal that's an octave below the original.

For Air Supply, snare frequencies were centered around the 80Hz range; via the model 500 the audience heard the snare at around 40Hz. In this way I get more punch from the snare, and put out a nice fat sound.

For effects, channels 17 and 18 received a drum submix return from a Lexicon 224X running V8.2 noise-gate software. In addition, dbx model 904 noise gates were inserted into channel inserts and the 224X returns, except for

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Curves have been smoothed for purposes of comparison.

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Table 1. House mixer channel designations and signal processing used in channel inserts. Input channels 1 through 15 were handled on the first Midas PRO4A console, channels 16 through 40 on the second and 41 through 60 on the third.

Channei Number	Sound Source	Effects	Channel Number	Sound Source	Effects
1	PZM kick mic	904 gate to DN30/30 EQ to model 160 limiter	30	Roland Jupiter 8 DI	
			32	Stage left DX-7 DI	model 160 limiter
2	Linn LM-1 kick DI		33	Stage right DX-7 DI	model 160 limiter
3	Snare top mic	904 gate to	31	Keyboard effects return	
		DN30/30 EQ to model 160 limiter		Yamaha CP80 DI	model 622 EQ to
4	Snare bottom mic	904 gate to DN30/30 EQ to model 160 limiter	35 Vocal mic		model 160 limiter DN30/30 EQ to model 165 limiter
5	HI-hat mic	_	36	Lead vocal mic	DN30/30 EQ to
6	Rack tom No. 1 mic	model 904 gate			model 165 limiter
7	Rack tom No. 2 mic	model 904 gate	37	Vocal mic	-
8	Rack tom No. 3 mic	model 904 gate	38	Vocal mic	—
9	Floor tom No. 1 mic	modei 904 gate	39	Vocal mic	-
10	Floor tom No. 2 mic	model 904 gate	40	Spare	-
11	Overhead mlc right	_	41	TEAC A3440 track #1	-
12	Overhead mic center	_	42	TEAC A3440 track #2	
13	Overhead mic left	_	43	TEAC A3440 track #3	-
14	Linn LM-1 snare DI	_	44	Lexicon 224 left return	-
15	dbx model 500 output	_	45	Lexicon 224 right return	—
16	Simmons kit mix DI	_	46 Lexicon Prime Time return		-
17	Lexicon 224X left return	904 gate	47	Lexicon Prime Time return	-
18	Lexicon 224X right return	904 gate	48	Roland model 555 DI	-
19	Electric guitar left mic	904 gate	49	Eventide Harmonizer return	-
20	Electric guitar right mic	904 gate	50	Moog Stage Phaser return	-
21	Bass/synth left DI	model 622 EQ to	51	Lexicon model 200 return	-
		model 160 limiter	52	Lexicon model 200 return	
22	Bass/synth right DI	model 622 EQ to model 160 limiter	53	Neumann U87 mic center	
23	Rhythm guitar mic		54	Neumann U87 mic stage-left	
24	Acoustic guitar left mic		55	Linn LM-1 mix DI left	
25	Acoustic guitar right mic		56	Linn LM-1 mix DI right	-
26	Yamaha C25 DI	model 160 limiter	57	Introduction tape left	
27	Yamaha DX-7 DI (panned left)		58	Introduction tape right	-
28	Yamaha DX-7 DI (panned		59	Playback tape left	-
	right)	·	60	Playback tape right	
29	Memorymoog DI				



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The author's drum micing for Air Supply included a Crown PZM on a plexiglass sheet to cover the kick drum, Beyer M-201 on snare, AKG C460 on hi-hat, Sennheiser MD-421s on floor toms, AKG C414 on rack toms, AKG C460 on ride cymbal, Neumman U87 for ambience and AKG C414s for overheads.

drum overheads and high-hats channels, which were free from any noise-gate processing. The toms were gated very fast and tight, giving a strong top- and bottom-end response.

As can be seen from Table 1, a second 25-input Midas board handled guitars, stereo bass guitar, a Minimoog bass synthesizer and bass pedal effects. Acoustic guitar was run in stereo—with one side out of phase relative to the other—and a Eventide Harmonizer patched onto the output to provide a type of big, "George Harrison-style" acoustic guitar sound.

Stage-right keyboards, performed by Dave Shelander, consisted of two Yamaha DX-7s, a C25 and, periodically, a Roland Jupiter connected via MIDI and run in stereo through the second Midas desk. An additional pair of DX-7s, plus a Yamaha CP80 piano for stage-left keyboard player Frank Esler-Smith, were also run into the second desk, with corresponding effects channels programed by the performers on stage.

To make the keyboard mix sparkle, I connected an EXR Exciter across the stereo keyboard subgroup output.

Although I made primary use of a Lexicon 224 for processing vocals by Graham



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Steve Zelanka with Jermaine Jackson during a pre-concert sound check.

Russell and Russell Hitchcock, the device was also patched for piano and guitar solos. The main vocal mix was connected through a Lexicon Prime Time for stereo effects, plus a model 200 with various programs, such as a 100ms predelay for reversed echo sounds.

All vocals passed through one side of an Aphex Aural Exciter; the other side was dedicated to subgroups 1 and 8 to provide good attack on snare, kick and vocals in the 700Hz to 7kHz range.

A third 20-input Midas board was configured as a submixer for all effects returns, apart from the Lexicon 224X drum patches. For high-hat and drum overhead I used a Moog Stage Phaser on an aux send and returned to a separate channel. The remainder of the board was configured for main vocals, using the Prime Time and model 200 for stereo out; backing vocals via the Lexicon 224; a Roland model 555 Tape Echo for multiple repeats on vocal effects and guitar; two channels (stage center and stage right) for ambient micing; and a Linn LM-1 stereo mix. Four additional channels handled replay of introduction music and special sound effects employed during the opening song.

Drum micing

With Air Supply, I was trying to achieve so many epic, orchestral sounds that I ended up using different reverb systems on the drums to enhance and make the entire percussive sound more distinctive and varied.

Ralph Cooper is physically a very small drummer and had only a 20-inch kick drum. To achieve a larger bass sound, I 'mounted a Crown PZM on a 12" x10" x½" plexiglass sheet, which was then placed inside the drum shell. The PZM output was gated quickly, compressed, boosted in the 80Hz-100Hz range with a Klark-Teknik DN33 third-octave graphic, and finally connected through the dbx model 500 Boom Box.

A second kick sound, which was intended to provide mid and high slap, differed somewhat from the first setup. What I referred to as the Linn "Drum-Trigger System" involved patching outputs from a dedicated Sennheiser MD-421 kick mic, the snare top mic and a C-ducer contact mic mounted on top of the snare, to a Linn LM-1 drum machine located at the house-mix position. (The MD-421 kick and snare top mics were first routed through a pair of dbx model 160 compressors and then to the Linn kick and snare trigger inputs.)

Separate snare outputs from the Linn were routed to two channels on the first Midas desk. Output from the C-ducer contact mic on the snare was sent directly to the Linn machine, and used to trigger percussive effects. I used a Roland Boss digital sampler containing a sampled Linn Clap sound to manually trigger handclaps for outros on specific songs. Oddly, drummer Ralph Cooper didn't have the Linn composite drum mix routed to his on-stage monitors. Instead, monitor engineer Bill Chrysler sent Ralph a mix of the natural kick miced with the Sennheiser MD-421, and a Simmons kick. Because of feedback problems associated with the latter's hemispherical pickup pattern, we used the 421 for monitor feeds instead of the PZM. In addition, a Simmons kick sound was preferred to that of the Linn, which only provides a single output lacking the Simmons' dynamic qualities.

Mounted beneath the snare was a Beyer M-201 mic, while the high-hat received an AKG C460 with a CK5 capsule. On rack toms I used tightly gated AKG C414s and, on floor toms, Sennheiser MD-421s. For ambient micing, Neumann U87s—one for floor toms and one for rack toms—provided a sharp attack on the tom sound. I also received a mono mix from the Simmons electronic kit.

For acoustic drum overheads, my micing preferences vary sometimes. On this date, I used two C414s as overheads and, for ride cymbal. a C460 with a CK8 capsule. Both microphones are different, with the C414s sounding fatter and splashier, and the C460 thinner and crisper. On some dates, however, dependent on stage acoustics and other factors, I used three C414s or three C460s to cover drums.

Future trends

Musical styles and tastes are constantly changing. Back in the early Seventies, a driving lead guitar and up-front vocals predominated in most rock songs. Today, the emphasis on different instruments has shifted. The solid back beat—a



Author Steve Zelenka at the trio of consoles mixing front-of-house sound for the Air Supply tour.

percussive drum sound that drives 12-inch dance mixes—is dominating new wave music. Studio engineers are now mixing up to 24 tracks of natural, synthesized and electronic drums, laying the resultant mix as basic percussion tracks for today's album sessions.

A live-sound engineer definitely needs to duplicate the original sound of an album while mixing a concert date. In the case of Air Supply, the band's original album sound tended to be uneventful, compared to in-concert performances. In general, it lacked great production. But, with the 1985 album *Air Supply*, the band showed that they were capable of some interesting production work, thanks to producers Bob Ezrin and Peter Collins. I try to enhance the band's musical personality as a whole, without deviating too far from the traditional Air Supply sound.

But, there are recurring problems that consistently plague a live-sound engineer. Take acoustics, for example. Some arenas are very problematic, but I always try and get a decent sound regardless of whatever hall we're using and whatever speakers have been supplied. On the recent Air Supply tour, we used Meyer MSL-3s supplied by Tasco; there were 10 cabinets per side, augmented with five subbass speakers, a combination that sounded very efficient when flown together.

I can get around many reverb problems by equalizing the house PA system. But, if the venue has exceptionally bad reverb or slap-echo problems, I'll try and compensate by setting up a different RT_{60} time for the vocals, so that the singer's voice floats in the hall. I love ambient arenas, because of the resultant



Stage mixing duties for the Air Supply tour were covered by Billy Chrysler, seen here with the Midas console. a rack of Klark-Teknik graphic equilzers and Crown DC-300A power amplifiers.

drum sound, explosive toms and flowing vocals that you can achieve.

In the future there will be less live shows. Bands will probably just cover the major marketplaces: Los Angeles, New York, Chicago, Houston and that'll be it. The rest of the country will see the show via a satellite simulcast. Because top bands will be touring fewer cities, the sound crew will have more time to set up better equipment at larger arenas. All of which should make for the *perfect* sound check.

Photos by Diane Fulton.

Hands-On

Applied Research and Technology

DR1 Digital Reverberation System

The past year has seen a number of low-cost digital reverb systems hit the market as the price of technology starts to drop. The ART DR1, with its true 16-bit linear architecture, is a prime example of combining high-quality sound with comprehensive MIDI control in a small ergonomic package, and bringing all this to the user at a modest price. Before writing this report, I spent two days at the Plant Studios, Sausalito, CA, running a variety of instruments through the DR1, and then used the unit on a mix session plus a live gig. Let's take a look at the results.

The DR1 simulates a variety of acoustic spaces, including halls, plates and rooms, while providing a number of special effects. (See Table 1 for a listing of factory presets.) The unit comes with

Bob Hodas is **RE/P**'s evaluations and practices consulting editor.

By Bob Hodas

40 programs in protected memory locations and has the ability to store 100 user programs.

Inputs are actively balanced and the outputs single-ended. Access is via $\frac{1}{4}$ -inch jacks that accept either TRS or regular phone plugs. Input and output may be either mono or true stereo mode. A rear-panel switch selects high- or low-level input sensitivity, depending on whether you are interfacing with +4dBV or -10dBV equipment.

Other back-panel controls include a Dry Kill switch that eliminates the dry input signal from the outputs. This switch is very handy when using the DR1 as a side-chain effect with returns run back into a console. A footswitch jack can control different assignable functions in the Kill/Infinite mode.

A remote control provided with each unit plugs into a rear panel modular telephone jack. Although the DR1 remote controller comes with a 14-foot cable, a standard 4-conductor telephone extension cord can be used if longer distances are needed.

MIDI In and Out jacks provide some of the most extensive MIDI control capabilities available on any processor made today. The real-time MIDI parameter control and mapping, called Performance MIDI, makes this unit desirable for keyboard players and composers using sequencers. (See accompanying sidebar by Dennis Hannigan on page 59.)

Front-panel controls

Front-panel controls are well laid out and easily mastered. A segmented LED meter displays input level as well as overload. Two independent sliders for right and left channels control input levels and reverb-to-dry signal mix. Preset programs, user storage locations and parameter values are displayed in large LED windows. I like the large LEDs much better than the LCD windows used by some manufacturers, because they may be viewed from a variety of angles without sacrificing readability.

Buttons indicating an up or down direction scroll through the values and operate at either fast or slow speeds. Not being able to directly call up the required programs can be an inconvenience but, because you can scroll through all 137 program locations in only four seconds, this turned out to be a minor problem.

What made the DR1 much less intuitive to operate was the fact that programs are displayed as a 2-digit number or letter/number combination. In order to identify which hall or plate has been called up, the user must continually refer to the supplied quick reference card and make a list of user program locations. A larger display showing program names would have been greatly appreciated.

Programs currently running display an LED in the preset window. If any parameter is altered, this LED is extinguished, indicating a deviation. I liked the fact that you could be running one program, call up another, and then initiate it at your discretion by pressing the Recall button.

All factory presets are permanently locked into memory; user locations can be locked for strorage, or unlocked and modified at will. User presets are easily created by manipulating the parameters of a factory preset, then moving to an unlocked storage location and pressing the Store button.

The DR1's strong point is that it offers a great deal of versatility in parameter manipulation. Five bicolor LEDs indicate which parameter is up for adjustment, while the values of that parameter are displayed in a bright, 3-digit alphanumeric LED display. Values are adjusted in the same manner as programs. All Room, Hall, and Plate programs share the same parameters displayed on the front panel.

Table 2 shows the available control parameters and value limits. I really liked the Diffusion parameter, and felt it important in defining the density of reflections. The DR1 is capable of creating some very dense programs that are great for handling lots of bass input.

I also was impressed with the ability to set stopped (Decay) and Running (Minimum Decay) reverb times on all programs. The DR1 senses the input level and then switches to the longer decay value when the input drops below a certain threshold. This provides you with the ability to use short reverb times while the input is dense, thus maintaining clarity in the track, and retaining long reverb tails in the spaces.

The third parameter that makes my day is Position, which (as the name suggests) allows you to simulate the distance relationship from the apparent sound source. It really does work; I was left with the distinct impression of walking farther back into a hall's reverberant sound field as I increased the controls. When hooked up to a MIDI controller or sequencer, you can create some realistic feelings of movement.

Because the unit is software based. I encountered problems identifying controls as EPROM updates and more programs are added. Table 3 shows how the seven parameter descriptions change when using DDL and Flanger/chorus special-effects programs. I found it it inconvenient to continually refer back to the quick reference card in order to do any manipulations.

The manufacturer should supply a small template that would fit over the value descriptions for each special-effects program. This would speed up adjustments and put the information where it belongs—at the engineer's fingertips.

It is comforting to know, however, that ART is continuing its research into new

There are many ways to split a mic, but only one way is best

Jensen MB-series Mic Splitter Transformers

When you need to split a mic, you should use a transformer pecause it provides a balanced, isolated signal to the input of each mixer; none of the mixers' grounds need be connected to each other (via the mic cable) so ground-loop induced noise is easily avoided. There must be a Faraday shield on each winding so that the transformer will not provide a path for capacitive coupling of common mode noise.

JENSEN TRANSFORMERS are best because, in addition to meeting these requirements, they minimize degradation of the mic signal's frequency response, phase response, and distortion characteristics. To prevent common mode noise from being converted to a differential signal, each end of every winding in a JENSEN TRANSFORMER has its capacitance precision-matched to that winding's Faraday shield. These are just a few of the reasons why most engineers end up using JENSEN splitter transformers.

The JENSEN JE-MB-C, JE-MB-D and JE-IMB-E microphone bridging transformers will split a mic signal to 2, 3 or 4 mixers.

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Circle (24) on Rapid Facts Card

Table 1. Factory supplied preset programs.

Preset	Room	Description	Preset	Room	Description
F0	EF.1	Character	H4	ddl	Ping-Pong
F1	P1.0	Super Tight Plate	H5	ddl	Echorec
F2	P2.0	Tight Plate	H6	R5.0	Pop Room
F3	P3.0	Medium Plate	H7	P3.0	Tunnel
F4	P4.0	Open Plate	H8	R4.0	Dynamic Room
F5	P5.0	Large Plate	H9	R4.0	Dynamic Pump
F6	R1.0	Living Room	JO	R5.0	Stereo Image
F7	R2.0	Medium Bright Room	J1	R2.0	Early Reflection
F8	R3.0	Large Smooth Room	J2	EG.0	Gated Snare
F9	R4.0	Large Empty Room	J3	EF.2	Downward Percussive
G0	R5.0	Large Night Club			Flance
G1	H1.0	Practice Hall	J4	FC.1	Short Flange
G2	H2.0	Natural Room	J5	FC.1	Long Flange
G3	H3.0	Medium Hall	J6	FC.1	Chorus
G4	H4.0	Large Hall			
G5	H5.0	Event Hall	Perform	ance Midi	:
G6	EF.1	Cavern	J7	H3.0	Key Velocity-Decay
G7	EF.1	Canyon			Time
G8	EF.2	Flange			Mod Wheel-HF
G9	EF.2	Step Flange			Damping
H0	EF.2	Drone	J8	H3.0	Mod Wheel-Decay
H1	ER.0	Reverse Slap			Time
H2	ER.0	Reverse Swell			Key Number-Position
H3	EG.0	Gated Echo	J9	H3.0	Key Number-Decay
					Time
					Mod Wheel-Position

Table 2. Control parameters and ranges for Room and Hall programs.

Control	Description	Values
PRE DELAY DECAY HF DAMPING POSITION K/I MODE DIFFUSION MIN DECAY	Pre Delay Decay Time HF Damping Position Kill rev. decay, Inf. Diffusion Min Decay (max#Decay Time)	0-200 ms 0.1-25 s 0-19 0-9 0-3 0-9 0.1-25 s

Table 3. Control parameters and ranges for DDL (top) and Flanger/Chorus special effects programs.

Control	Description	Values
PRE DELAY	Regen Delay	0.01-1.00 s
DECAY	Left Tap's delay	0.01-1.00
HF DAMPING	HF Damping	0-19
POSITION	Regen	0-19
K/I MODE	Kill rev. decay, Inf.	0-3
DIFFUSION	Unused	
MIN DECAY	Right Tap's delay	0.01-1.00
Control	Description	Values
PRE DELAY	Left Base Delay	0-100 ms
DECAY	Left Sweep Width	0.1-8.0
HF DAMPING	Sweep Speed	1-25
POSITION	Regen	0-19
K/I MODE	Kill rev. decay	0-2
DIFFUSION	Right Base Delay	0-100
MIN DECAY	Right Sweep Width	0.1-8.0

software, which can be added as a simple chip replacement.

The final control is the Kill/Infinite mode (K/I), which can be controlled via a front-panel button or the footswitch mentioned earlier. You can assign one of three functions to this switch: kill the reverb; kill the decay but leave the reflections; or hold the reverb infinitely. In the DDL program, mode 2 kills regeneration and mode 3 acts as a repeat hold. K/I is just one more control that provides the DR1 with creative power.

Operational assessment

I learned all the DR1's operating functions quickly, which speaks well for its operational design. Adding to the convenience is the small remote that allows total parameter and program control. Except for the Store function, all frontpanel functions are duplicated on the remote, making it a versatile tool.

The DR1 was quiet. The first thing I listened to was the unit's output noise. I hooked up only the outputs to the console and ran the faders all the way to the top. This unit turned out to be only about 5dB noisier than the digital reverb unit I use for noise comparisons, which makes it one of the quietest on the market.

Soundwise, the DR1 has a definite personality. The algorithms are bright and strong throughout the mid-range frequencies. There is also a lot of high-end response, which is desirable on some instruments but unacceptable on others. I found that on most instruments, 1 used the High Frequency Damping parameter more often.

Generally, both sustained and staccato keyboards sounded good with most programs. Guitar was also flattered in many cases. What surprised me the most was just how good kick drum and tom-toms sounded due to the high amount of diffusion available. The unit is able to do incredible things with bass-heavy instruments.

The Room programs had good variation but were pretty bright. The Halls sounded realistic and had lots of good applications. Several programs reminded me of the type of coliseums and halls in which I have mixed live sound while on the road. The larger halls had the same characteristic reflection "rings" that I have found in all digital reverbs.

Some special effects programs impressed me more than others. The DDL programs all had excellent bandwidth and provided a variety of useful and pleasing delay effects. The Flange, Chorus and Gate programs didn't do anything special for me, but the Reverse programs were fun, and the Pop Room was good. There are also a couple of large spaces,

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Instead of trying to describe all 37 factory presets, let's look at a few instruments and where the best applications lay. Please be aware that, except for keyboards and guitars, I performed some heavy parameter manipulation on all factory preset programs to obtain the desired results. This has convinced me that the DR1 was designed more for keyboard players than engineers, especially when you take into account the MIDI Performance capabilities. But, with 100 storage locations available, I felt strongly that there was nothing stopping me from

Technical Specifications

Input: stereo $47k\Omega$ balanced; +12dBV max.

Output: stereo/mono; low impedance; unbalanced; + 12dBV max. **Operating level:** High = 0dB; Low =

- 12dB; rear switchable. **Dynamic range:** greater than 90dB in all modes.

Frequency response: 35kHz dry; 14kHz reverb.

D/A converter: 16-bit linear.

Software (Rev. level 1.2)

Decay time: 0.1-25 seconds for all normal rooms; different in some effects programs.

Pre-delay: 0-200ms in 1ms increments; different in some effects programs. Factory presets: 40 (37 main programs, plus three Performance MIDI programs).

User presets: 100; internal battery back-up.

Room types: 21.

MIDI receive channel: 1-16, Omni, on/off.

MIDI program: 0-127; assignable to any preset.

Performance MIDI: allows the DRI to respond to MIDI messages such as Note On Velocity, Mod Wheel, Pitch Wheel, After Touch, and others Control any of two values that define a preset in real time during live performance.

Circle (125) on Rapid Facts Card

doing it my way.

I had mixed feelings about processing snare drums with the DR1. If I put in an "English sound," with lots of top and bottom but very little in the mid-range, I found some good applications. When I processed a tight snare with lots of crack or ring, I found the results to be much less than pleasing.

My general fix was to EQ the effects send and roll out a lot of the information, causing the midband overring. When I did this, the original drum sound could be well matched with the reverb. As a rule of thumb, I got the best snare sounds by using lots of HF Damping, keeping Diffusion low, and placing the listening Position at medium to close. The programs that I liked best were F7, F8, G0, H2, H6, J0 and J1.

I had lots of fun with **kick drum**. I achieved a beefier bottom end sound by running both outputs with no panning on the console; it also helped reinforce the kick image. To achieve the best results, I used high Diffusion with distant room positions. For standard reverb, programs F4, F7, F8, G4 and H6 worked well. For special effects, G5 with heavy manipulation and H3 sounded good. I found H1 has some good applications for Rap (sort



G · SERIES STUDIO COMPUTER

of syncopated rhythms with a backward metal zipper in a can, if you can dig it).

Toms were pretty happening when processed through the DR1. The low-mid I didn't like on snare was just what the doctor ordered for toms and kick. F3, F6, F9, G5, H7 and H8 were my favorites. I used short decays combined with high Diffusion and mid to distant Positions.

The toms also took well to special effects, with the Flange programs (J4, J5) adding some nice harmonics, and making the toms stand out in a mix without washing them out in reverb.

The Gated programs (J2) sounded better on toms than on snare. I really haven't found a digital special effects device that produces a gated reverb program that sounds as good as one you can build with real gates, but this is not bad.

I found after testing drums that I yearned for a low-frequency control on the DR1. In some cases, I could have had more bottom; with as many parameter options as the DR1 provides, it's too bad that ART left out LF adjustment.

Keyboards, whether sustained strings, horns or staccato pieces, sounded good with almost every factory preset. It is easy to see why the DR1 would be a strong addition to a keyboard player's effects rack. F1 had some rich harmonics without the feelings of reverb. Plates 1-4 were good too. All Rooms had application, except for the Large Empty Room, which sounded just like its description. All Halls were nice and effective.

DDL's, Flanges and most other special effects provided creative stimulus. It would be advisable to watch out for some of the larger programs and effects, such as J1, in which long delays can pull the keys out of pitch.

The medium to large rooms really open up for **guitars**, with F8 and F9 being the best sounding. I thought that the Hall really sounded like some of my road gigs, but I have become tired of battling those acoustics. It is good to know that the sound can be recreated if that's what you want. H1 was fun, and H5 took me back to the days of Elvis; great for solos too.

For lead and background vocals, l found that the strong low-mid in the programs could pull the vocal further out if the singer was a bit off pitch. My fix was to EQ the return by rolling out a couple of decibels at 400Hz with a broad bandwidth. This was effective at smoothing out the reverb and was used for both lead and backgrounds.

Tight plates F1 and F2 worked well for

lead vocal, but the larger plates were unruly. F7 worked well for the lead vocals also, and the DDLs sounded full range and capable of some good moving vocal effects. Backgrounds sounded best in F9, G3 and G4, and H6 was pretty good. For a large airy sound, I used larger spaces with short decays and far Positions.

The manual is easy to understand and operation can be picked up in no time. Extensive documentation is provided for MIDI operation. Concerning maintenance, however, there are no schematics. Inside, the DR1 is well laid out and should be easy to repair, but it must be left to someone familiar with heavily software-based systems.

The ART DR1 has many good control functions that give the user as much creative input to the programs as they desire. The bright sound will not be all things to all people (or, should I say, instruments), but there are plenty of programs that, with some listening and manipulation, will create some very pleasing and interesting spaces. The DR1's affordability makes it an attractive main reverb for a small studio, a secondary unit for a large studio, and a highly controllable addition for keyboard players and composers.

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Static and Real-Time MIDI Control of the ART DR1

By Denis Hannigan

The DRI can receive on any of the 16 MIDI channels, in either Omni or Poly mode. In Omni mode the slaved DRI responds to data being sent on all 16 MIDI channels; no channel assignment is necessary. In Poly mode, the slave only receives on a preselected MIDI channel. To communicate in this mode, the transmitter (usually a sequencer or keyboard) and the DRI must be set to the same MIDI channel.

In MIDI Program mode you can assign any of the DRI presets to 128 MIDI program slots, which allows reverb and effects presets to be changed from a keyboard. When you select a keyboard patch, the corresponding DRI preset changes with it. There is also an incremental preset mode for setting up a series of presets that loop. However, this preset mode can only be effected from the DRI's front panel or remote unit and not via MIDI.

Another handy feature is a kill preset, which turns off the unit's output upon receipt of a MIDI program change command.

The DRI responds to both system exclusive and non-exclusive messages. Non-exclusive messages are used for commands such as note on, note off, modulation wheel changes and timing information. They are the most common MIDI messages and are not specific to any manufacturer's equipment. System exclusive messages, on the other hand, are specific to each manufacturer's equipment, and allow the DRI to communicate information in such a way that it doesn't interfere with other products connected to the MIDI interface.

Applications of system exclusive messages include recording preset changes and value changes into a sequencer, or the ability to edit parameters on a computer and store them to disk. You can also dump presets from one DRI to another.

Real-time MIDI mode

In Performance MIDI mode vou can simultaneously control two of the current front panel values with MIDI messages. For this Hands-On review, I used a Yamaha DX-7 as controller keyboard, both because of its popularity in the studio and the number of available controllers (pitch bend, mod wheel note on/off, velocity on/off, after touch, breath controller, data entry slider, and foot controller). Adjustable values on the DRI include front-panel value affected, MIDI messages used, scaling (adjustable from -128 to +128) and starting/center value (see Table A for details).

For example, to control the decay time of a reverb room (front-panel value) with note on velocity (MIDI message), I first set the scaling to a + 44(the higher the number, the greater the front panel value will change in response to the MIDI message), and then set the starting'/center value of the decay time at 2.0.

You can also set the scaling to a negative value to establish an inverse relation between the DRI's front-panel value and the MIDI message. For example, to control the HF Damping with note on key number, I set the scaling to a - 52. While playing the DX-7, the HF Damping is now decreasing instead of increasing.

By combining these two settings, the harder I pressed the keyboard, the greater the reverb decay time. And the higher up the keyboard I played, the brighter the room sounds. In a sense, I can now tailor the reverb to a particular keyboard performance; as can be seen, Performance MIDI opens up a lot of creative potential.

It's easy to record the DRI's Performance MIDI data into a sequencer. One way is to record MIDI settings live as you record the keyboard parts. This takes some getting used to, since your keyboard style (attack, mod wheel, pitch bend, etc.) can affect the reverb and effects parameters.

Also, watch out for processor timing delays—making quick, radical changes on certain parameters can cause slightly audible glitches. For example, when using note on velocity to affect decay, if you play a key hard and immediately follow it with a soft attack, the processor will adjust to the last velocity played, and reverb decay will cut off abruptly. You can avoid this effect by using the correct scaling.

The quantization (resolution) of the controller you are using can also cause glitches. The mod wheel (14-bit) gives you smoother control than pitch bend (7-bit), especially for greater value changes; the musician's playing style should be adjusted to compensate for these differences.

An alternate method of sequencing with the DRI is to record the music data first, without effects. Then, while monitoring the previous MIDI tracks, lay down a track or two of MIDI controller messages. This way, you can concentrate on the reverb and effects performance separately from the music.

Another major benefit of Performance MIDI is the ability to edit and store effects presets to floppy disk. At least one company, MusicSoft, has developed a visual editor program for the IBM PC and compatibles, with an Apple Mac version to follow soon. The program provides a full-screen view of all DRI parameters and functions, plus assignment of MIDI programs and Performance MIDI settings. Such features are invaluable for fast editing, preproduction and keeping a record of effects settings after projects are done. With access to some powerful se quencing software, you can analyze the MIDI data stream and actually change the controllers after the fact. For example, you can take a sequenced track of music and assign controllers to the performance contours to guide the DRI. Or, if you've recorded the MIDI data corresponding to an effect you like, just cut and paste it where you want it in the MIDI sequence.

For random effects, I took a keyboard track already containing controller information and played it through the DRI. Some interesting results can be found in this roundabout fashion.

Applications

For the musician/producer, Performance MIDI opens up a whole new world of creative possibilities. You can interact creatively with the DRI as an instrument and record your performance to tape or disk. Even after experimenting briefly, I came up with some interesting settings.

Try note on key number to increase decay, and note on velocity to increase HF damping. In this setting, the lower keyboard notes you play, the less decay (bass notes are clearer) and the greater your attack velocity, the darker the room becomes (more presence).

Or set note on velocity to increase decay, and modulation wheel to decrease decay; you can now build up to crescendos with a long decay and then decrease with the mod wheel.

For delay effects, set the note on velocity to increase regeneration and the mod wheel to kill it. Or another choice is to use the mod wheel to increase regeneration, and the pitch bend or foot pedal to kill the effect.

I like to create special effects using the DRI's DDL room and percussive flange/drone rooms. Assigning controllers to delay taps, drone frequency or sweep width quickly achieves some interesting Twilight Zone-type effects!

Using a breath controller adds a new perspective to manipulating an effects processor. As a woodwind player turned keyboardist, I find the DX-7's breath controller especially valuable. The ability to change room size or add delay to choice sections by using your breath is helpful if both hands are busy playing parts.

For the engineer/producer, the applications of real-time MIDI are downright exciting. With access to a device such as the Yamaha MCS2 MIDI control station and a few MIDI-capable effects processors, programming and storing complete reverb/effects mixes are possible.

For live mixing, complete setups can be stored in preproduction and then modified during performance. The end result can be saved for future use or passed to another engineer working the same venue. In the studio, a second engineer can learn to program a MIDI controller and work with the producer to set up the effects. Settings can be fine tuned in real time, while the first engineer sets up the mix. Linked to a computerbased MIDI sequencer, the mix can be recorded and saved to floppy disk.

Many people will take a while to warm up to MIDI-capable devices like the DRI. As music technology snowballs, it seems as if our new product manuals are forever open. As an avid MIDI user, I'm excited about the potential of Performance MIDI. It will allow more dynamic control over effects, creating and storing settings in production, on-screen editing and storage, sequencing complete reverb/effects mixes, saving them to disk and more of a musical/performance interface with effects processors.

Denis Hannigan is a composer/synthesist and a contributing writer to RE/P.

Table A. Performance MIDI values and controller messages.

Front panel value affected:

- Performance MIDI off
- Pre-delay
- Decay
- HF Damping
- Position
- K/I on/off
- Diffusion
- Min Decay (not applicable to Performance MIDI reverb rooms)

MIDI Controller Messages:

Specific:

- Note off key number
- Note off velocity
- · Note on key number
- Note on velocity
- · Poly key pressure
- · Channel pressure
- Pitch bend

14-bit Controllers:

		1
 Mod wheel Breath controller Unassigned Foot controller Portamento time Data entry Main volume Balance Pan Expression pedal 	(1, 33) (2, 34) (3, 35) (4, 36) (5, 37) (6, 38) (7, 39) (8, 40) (10, 42) (11, 43)	
7-bit Controllers:		
 Hold pedal Portamento Sustenuto Soft Pedal 	(64) (65) (66) (67)	R·E/P



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Larry Brown, Producer/Engineer

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Dan Healy, Sound Engineer, The Grateful Dead

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Lars Brogaard, Sound Engineer



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Legal Aspects of Digital Sound Sampling

By Henry V. Barry

When using sound samples, recording and production engineers should carefully check the origins of the digital data, if only to protect themselves from possible copyright infringements.

Sampling devices often create some interesting dilemmas. After a session during which several thousands of dollars have been spent on hiring the best string players available-which players happen to be playing a simple line that would be quite easy to sample-what recording or production engineer has not considered making a sample of that sound for future use? Or, when participants in a session have been struggling for hours to achieve a respectable drum sound and meanwhile you come across a CD containing a great sounding drum break that can be sampled, triggered from an existing acoustic drum track and added to the mix, who will refuse and why? Finally, when someone offers you a diskette containing a sound sample, is it legal to make a copy of it?

For everyone involved in the recording process, the use of digital sampling devices raises these and other interesting legal and ethical questions. This article will examine some of those questions and set guidelines for the use of sampling devices and sound samples.

Most of the legal questions that arise

Hank Barry is an attorney at Cooley, Godward, Castro, Huddleston & Tatum, Palo Alto, CA. regarding digital sampling center upon copyright ownership. They involve who owns what and, often more important, who can stop whom from doing what with a particular sample. In the case of digital samples, the answers are determined mainly by a congressional policy of providing a lower level of copyright protection to "sound recordings" than is given to other categories of works.

First, I'll discuss the general protections afforded by the Copyright Act of 1976 and how they are obtained. This will be followed by a discussion of how samples and other sound recordings are distinguished under the current copyright law, from computer programs, musical compositions and other literary works.

Establishing copyright in sound recordings

Under the Copyright Act of 1976, copyright exists from the time of creation in "original works of authorship fixed in any tangible means of expression, now known or later developed, from which [the works] can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."

The standard for originality is not very

high, and usually is taken simply to mean that the author did not copy from someone else. The requirement of fixation in a "tangible medium of expression" is satisfied by affixation in any medium, such as magnetic tape or a floppy diskette. Recent cases have found that fixation in read only memory (ROM) also qualifies.

No protection is given to ideas under copyright, only to the expression of ideas. For example, there is no copyright protection for the *idea* of making an inverted snare sample, but each such sample made subsequently may be protected if it meets the originality criteria.

The fact that protection exists or "subsists" from the creation of the work means that works are protected by the copyright law, whether or not the creator (usually referred to as the author) has taken the time formally to register the work with the Copyright Office.

For sound recordings, the law requires that a form of notice, consisting of three elements, appear on all copies.

The first symbol is a letter P in a circle; second, the year of first publication of the sound recording; and third, the name of the owner of the copyright.

The medium of fixation is irrelevant;

sound recordings fixed in records, tapes, CD-ROMs, or other media such as diskettes (floppy or hard) or EPROMs are copyrightable, as long as they contain fixations of sound.

Who is the author of a sound recording?

The creator of a sound recording has a copyright in that recording from the moment he or she creates it. A recording is by definition a reproduction of something else. However, it is important to point out that the creator or author of the sound that will be reproduced, whether that person is a speaker, a singer, a writer and/or an arranger, must usually give his or her permission for the creation and copyrighting of the sound recording. (Defining the circumstances under which such permissions might not be required is very difficult. In all cases it is better to express permission in writing.)

Once the creator of a sound recording has assembled this bundle of permissions, he or she can create an independently copyrightable "fixation" and claim author status for that work.

Of course, the party that can actually claim the copyright may be someone

GLAR

other than the author, depending upon bargaining or employment relationships. A producer or engineer working for a record company, for example, will usually undertake a blanket assignment of the rights to his or her work to the label.

The creator of a sound recording has a copyright on that recording from the moment it is created.

Similarly, a musician who is recorded specifically for the purpose of producing samples will normally assign all the rights in the recording to the company or individual producing the samples.

Samples as "sound recordings"

The Copyright Act sets forth a level of protection for works that are sound recordings. The level of protection accorded, is sufficient to prevent the literal copying of sound recordings. It does not compare, however, to the greater protection accorded other categories of works, such as computer programs, musical compositions and literary works.

Sound recordings are defined as "works that result from the fixation of a series of musical, spoken or other sounds, but not including the sounds accompanying a motion picture or other audio-visual work, regardless of the nature of the material objects, such as discs, tape or phonorecords, in which they are embodied." In addition, this category includes tape recording of sounds.

The primary reason for according a relatively lesser degree of protection to sound recordings is historical in origin. Under the Copyright Act of 1909, no provision was expressed granting copyright in sound recordings. For the most part, record companies and other owners of sound recordings relied upon state copyright acts or judicially-developed legal principles for protection against piracy. Confusion regarding the legal status of sound recordings made it difficult to deter record pirates. Thus, the first federal statute expressly prohibiting the

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copying of sound recordings was passed in 1971.

Rights granted under copyright

We will now assume that all applicable permissions have been assembled and a recording has been made, whether it is a 50-minute analog tape recording of an orchestral work or an 8-second sample of a piano sound. The author of that record-

Once the creator of a sound recording has assembled the relevant permissions, they can create an independently copyrightable "fixation" and claim author status for that work.

ing, or the party claiming through such author, immediately receives certain rights under the 1976 Copyright Act. These rights are as follows:

To reproduce the copyrighted work in copies or phonorecords;

• To prepare derivative works based on the copyrighted work;

• To distribute copies or phonorecords of the work to the public by sale or other transfer of ownership, or by rental, lease or lending.

As noted above, there is no public performance right in sound recordings. The duration of the rights under copyright for sound recordings created after January 1, 1978, is for the life of the author and 50 years after the author's death. If the work is a work made for hire (a sound recording made in the course of a producer's employment by a record company), the rights endure for 75 years from the date of publication or 100 years from the date of creation, whichever is shorter.

Distinguishing sound recordings from computer programs

Because the information that comprises a sound sample is stored in digital form in memory or on a magnetic medium, it is tempting to think of that information as a computer program. Computer programs are eligible for full copyright protection (that is, their authors are granted more rights than the three listed above), subject to a statutory provision that grants owners of program copies the right to make an archival copy or adaptation of the program.

Under the Copyright Act, however, a

computer program is defined as "a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result."

The important thing to note about this definition is its "verbal" quality. A program is something used to bring about a result. This serves to distinguish, for example, signal processing *programs* (that manipulate data and produce a result) from the signals themselves.

Because samples are merely data and do not "bring about" a result, they are probably not programs under the Copyright Act.

Distinguishing sound recordings

The distinction between digital samples and musical compositions is fairly easy to see. It is perhaps more difficult to distinguish samples from other data in digital form, such as word processing or musical notation files, that do not bring about a result and are therefore not "programs" under the copyright law.

A block of data (such as word processing file containing a short story), assuming it meets minimal standards of originality, would be a digital representation of a literary work entitled to full copyright protection. A digital sample is also a block of data that does not in itself bring about a result and a digital sample would, therefore, most likely qualify as a literary work under the Copyright Act. However, the congressional policy regarding sound recordings discussed above may complicate such logic.

Although the courts have not been faced with the issue, I suspect that they will apply a genesis test for determining whether a block of data is a sound recording. That is, if the data "began life" in the analog world as a pattern of sound waves, the data will be considered a sound recording for copyright purposes. Under this test, for example, a sample of an acoustic piano would be sound recording. A digital representation of a waveform generated within a computer by an operator using a synthesis program would be a literary work, and a signal processing program would be a computer program.

Registration of copyright

Although copyright exists from the time a work is created, there are certain legal remedies that are available only if work is registered. Registration is accompanied by submitting to the Copyright Office a copy of the sound recording (two copies if the work has been published), along with a completed Form SR and a check for the registration fee. The required copies of the sound recording may be submitted on the media set forth on Form SR. Copies of Form SR and the forms used for copyrighting other types of works are available from the United States Copyright Office, Library of Congress, Washington, DC 20559.

Infringement of copyright in sound recordings In the case of all types of works other than sound recordings, the right to

Because samples are merely data and do not "bring about" a result, they are probably not programs under the Copyright Act.

reproduce the copyrighted work is not taken to mean that an infringer must make an identical copy of the work. There are numerous cases that define copying in a more liberal way. The cases say that copying can be proved by showing that the alleged infringer had access to the copyrighted work, and that there is substantial similarity between the copyrighted work and the alleged copy.

With respect to sound recordings, however, the law provides that only those reproductions "that directly or indirectly recapture the actual sounds fixed in the recording" are prohibited. Imitation or simulation of a sound recording is expressly excluded from the definition of infringing activities. A literal copy of a sound recording must be made in order to constitute infringement.

Of course, where there is literal copying there will be substantial similarity. A bit of electronic alteration will not alter this fact. In the criminal record piracy case of *United States vs. Taxe*, the defendants acquired records and tapes from retail outlets and then re-recorded them onto 8 track stereo tapes; they were altered by speeding up the recordings and adding echo and additional synthesizer tracks on a multitrack in the process. Their conviction for violating the copyright law was upheld.

Other defenses

If electronic alteration is not a defense to infringement by literal copying, what is? The answer is: "Not much." The line of cases that includes the *Betamax* decision would suggest that making a copy of a sound recording that you have pur-





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Sampling Realities: Frank Zappa's experience with his recent Jazz From Hell album

By Dan Torchia

For a producer or engineer, securing protection against unauthorized sampling may seem a remote possibility. Until the law catches up with technology, the short-term solution may be evolutionary, rather than revolutionary: treat sampling as just another form of sound recording and claim existing copyright protection.

One artist/producer who has taken just such a step is Frank Zappa. His most recent release, Jazz from Hell, is probably the first album that claims copyright protection against unauthorized sampling.

Not only is such a notice needed, Zappa says, but the copyright law should be changed to reflect the new technology.

The album's copyright notice states that "unauthorized reproduction/ sampling is a violation of applicable laws and are subject to criminal prosecution." The additions are relatively minor compared with a standard copyright notice, but Zappa felt the changes were needed.

"I suspected that something like this was going to come up maybe two years ago," he says. "I spoke to my attorney about it. He was completely unaware of the ramifications of it [sampling]. I took it upon myself to design the notice."

After examining the copyright law,

Dan Torchia is managing editor of RE/P and a free-lance guitarist/keyboardist.

Zappa concluded that there was no clear-cut language that refers to sampling. Because most of the copyright law was written at a time when sampling technology didn't exist, there is no clear legal definition, he says.

"I think the whole copyright law should be updated to include the most recent developments in technology," he emphasizes. "Whenever you have interpretational possibilities, that opens up a big can of worms."

Collecting samples

Because Zappa composes and records on a New England Digital Synclavier, he uses a variety of approaches to collect sound samples. Zappa hires musicians at \$100 an hour to play samples into the Synclavier. The musicians know that they are being sampled at the sessions, he says, and they sign releases that describe what the session is for.

Seven of the eight songs on Jazz from Hell were composed on the Synclavier, with one song being a guitar solo. Album information contains composition information and also credits the musicians who were sampled for the Zappa album.

Although he does not know of an instance where his music has been sampled, Zappa says that putting the copyright notice on the album was a basic business decision.

"I've never been confronted with that because my music is not the kind of thing that a person would want to imitate or steal; what I do is perceived to be not commercial. And the reason people steal things off other peoples' records is because they want a certain 'commercial' sound.

"Like stealing so and so's snare drum sound—or the other common instance—people taking CDs of the Star Wars soundtrack music and taking whole chunks of John Williams' score with the London Symphony Orchestra and using that for a string sweetener."

Identifying samples

If you think that one of your sounds has been sampled without permission, spectral analysis might provide some useful clues, Zappa offers. "You could use a Synclavier for example, to print out a 3-dimensional graphic depiction of a given sound."

"Even with echo modification and so forth, there could be enough tell-tale waveform intonation to help you identify a given sample," he says.

Until the law provides clear copyright protection against sampling, Zappa advises others to include similar notices to the one printed on the album cover for Jazz from Hell. Not only do people need to protect themselves, they also need to make sure that they aren't violating another musician's copyright.

"If you're going to do sampling," he concludes, "you have to give some consideration to the people who have already gone through a lot of time and trouble to put specialized sounds on records, and not be a bandit and steal those things from somebody else." chased or received over the air for your personal use in your home is not an infringement. Two other arguments that are often made are as follows:

Extent of copying. In the sampled drum-break example quoted above, the defendant might argue that the portion of the sound recording taken was so slight as to be insignificant. In general, the law responds to this argument by looking at how much was taken in relation to the whole, not only from a quantitative standpoint, but also from a qualitative one. If a particular drum sound recording is very important to the whole of the recording from which it is being taken, the taking of even a short portion may constitute infringement.

Purpose of the copying. In the example in which a diskette containing sound samples is duplicated, the person making the copy may claim that, although this is technically infringement, it is harmless because he or she does not intend to make additional copies and sell them. The opposition argues that this is infringement and, perhaps more importantly, if this type of activity were permitted the economic incentives that a copyright law is supposed to offer for the production of new works would be lost.

This is a difficult issue that will become more important as R-DAT recorders and other means of high-quality duplication become available.

It is a widely practiced form of infringement that raises ethical questions for those who believe that copyright provides an important incentive to the production of new works.

Remedies

In general, the remedies for infringement are injunctions against further copying, actual damages and recovery of the infringer's profits. Criminal penalties can also be imposed for certain types of infringement. Statutory damages (ranging from \$250 to \$10,000—awarded in place of actual damages and defendant's profits) and attorney's fees can be awarded only if the plaintiff has registered the work with the Copyright Office within certain time limits. Copyright litigation is usually very complex, and certain law firms specialize in this type of case.

Conclusion

The purpose of this article has been to point out some of the legal and ethical issues associated with sound samples and devices. Like tapes, samples are sound recordings that may be infringed. Like tape machines, sampling devices may be used to copy and thereby infringe rights in other people's sound recordings.

Because the incentives that the copy-

If the data "began life" in the analog world as a pattern of sound waves, the data will be considered a sound recording for copyright purposes. right law provides are particularly important for people working in the music industry, we should all try to keep that overall incentive structure in mind when deciding those seemingly unimportant legal and ethical questions that come up every day.

An outline of issues in software protection and licensing is available without charge from the author, c/o Cooley, Godward, Castro, Huddleston & Tatum, 5 Paio Alto Square, Paio Alto, CA 94306. Please enclose an 8'a''x11'' self-addressed stamped envelope with sufficient postage for five ounces of return mall.



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Mobile and Remote Recording

By Gary H. Hedden



A successful remote recording project usually results from many weeks of careful planning by specialists who somehow manage to anticipate potential disasters, and carefully formulate alternatives that seem to solve problems even before they develop.

Experienced studio producers, engineers or musicians may be thoroughly perplexed when asked to produce a live recording. They may not even be able to find viable companies that operate remote audio facilities. And once located, it may be difficult to evaluate the technical capabilities and staff of competing companies.

Without a doubt, developing and keeping the budget is equally challenging. Although this article will emphasize the remote multitrack recording of live concerts, mobile trucks have frequently been used to produce studio-like record-

Gary Hedden, who has been engineering remote sessions since 1962, Is president of GHL Audio Engineering, a Nashville-based company that operates a small studio and a full-scale remote truck.

Selection of Remote Recording Facilities

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Remote audio trucks can also be used to handle the complex requirements of video and film productions, mainly because even the most sophisticated video trucks just can't dedicate sufficient on-board space to handle multitrack music recording.

Perhaps we should first clarify an idealized way in which principle contractors work together in a typical liveconcert multitrack recording. Although an example would be helpful, the nature of remote recording is such that typical or normal just doesn't exist. Having experienced the recording of a 50-piece orchestra in the woods, a 1-time festival with some 15 different acts performing in one evening, a 24-track recording of a comedy show (one principle mic), a circus, rock and roll live-to-satellite and R&B produced in a garage, I'm certain that I am not yet through experiencing the wide variety of sessions available in remote audio.

Nevertheless, some general principles apply. First, for a live concert session, the recording facility and sound reinforcement should function as independent systems. Because mic and line signals from the stage area need to be routed to the monitor mixer, house mixer and the truck's recording console, complex grounding and impedance problems can develop when the systems are interconnected.

The objective here is to split the signals in such a way that the stage performance is virtually unaffected by the recording process. The recording engineer will probably want to add separate audience mics, and perhaps change or supplement the on-stage mics or direct-input lines.

For more complex shows, submixes

Full Sail's mobile is equipped with a 32-input Sphere Eclipse console, two Sony JH-24 multitracks, Otari MTR-10 and MTR-12 2-tracks, Fostex LS-3 and Yamaha NS-10 monitors, Roland SDE-3000, Lexicon 480XL, model 200 and PCM-41 digital effects, UREI, dbx, Aphex and Omnicraft compressor and noise gates, a Time Line Lynx time code synchronizer and a video/intercom system.



Omega Audio's mobile is equipped with a 38-input API console, JBL model 4430 monitors, two Otari MTR-90 24-tracks, two Otari MTR-102-tracks (with interchangeable 4-track on ½-inch headblocks), dbx model 160, 162 and 165 compressors, ADR Vocal Stressor, two UREI LN1176 compressors, Lexicon 224X digital reverb with LARC remote and a comprehensive RTS IFB and intercom system. and effect returns may also need to be connected to and from the recording equipment. For instance, the truck may return a backing-vocal submix to the house mixer, or the house mixer may send a critical delay effect to be recorded in the mobile truck.

Recording engineers are usually unable to improve the sound in the hall (ex-



Westwood One's Concertmaster I mobile features a Sony JH-636 console, Ampex MM-1200 multitracks and ATR-102 mastering transports, plus a full complement of processing equipment.

cept by offering a different selection of microphones). The sound reinforcement system, on the other hand, and especially the stage monitors, can adversely affect the recording's quality. It's easy to see that serious problems can arise if attitudes are inflexible.

Intercoms must provide quick access between the recording crew, staging crew, video production (if appropriate), and perhaps broadcast engineers, while isolated systems will allow individual crews to communicate among themselves. The audio truck might also use one or more closed-circuit video cameras to help anticipate changes on stage. During video shoots the audio crew will usually monitor at least one of the available production feeds.

Pre-production and communication

As in most situations, preparation and communication are the keys to success in remote recording. Before contacting a remote audio company, try to define the specific objectives of your recording. Live recordings may ultimately be used as an album, video soundtrack, broadcast or just for analysis by the artist.

In some situations, a stereo mix direct to ¹/₄-inch may be sufficient; others may require two multitrack machines with all the outboard goodies. Many times, the show is recorded on all available machines as additional assurance against equipment failure.



Le Mobile is equipped with a 32-input Neve model 8058 console with NECAM servo-controlled automation, a custom-designed 12-input submixer, two Studer A800 multitracks, two Studer A810 2-tracks, a Studer TLS2000 time code synchronization system, Dolby SR noise reduction racks, EMT 250, 244, Lexicon model 200 and Yamaha REV-7 digital reverb units, UREI LA-3A, LN1176, dbx model 160 and Neve model 32264A compressors, custom-designed monitoring using JBL drivers plus various video equipment.

If the direct 2-track mix is great, except for one portion of the show, a quick remix from the multitrack may complete the production. Allow the mobile engineers to determine the possibilities in advance, and you'll be able to control the cost without sacrificing production flexibility.

The budget is a familiar restriction in remote recording. Ideally, you should know what the business people would like to spend on the project, as well as the maximum available funding. During the event, you may need to make some quick decisions that increase the production cost. (Most remote companies won't



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release the tapes until all bills are fully paid.) If your first task is to prepare a budget, at least try to classify the level of quality desired by the investors.

Location shooting

If possible, inspect the location of the recording before shopping for a mobile truck. If you cannot actually visit the place, speak to the stage manager, or someone else in authority and determine any limitations imposed by that particular venue. Areas of concern could include electrical power, the routing of cables, parking, acoustical problems (like a particulary noisy air conditioning system) and extra costs for stage hands.

A typical mobile truck needs access to an electrical service rated at 100A, possibly 3-phase, with the supply being available at the start of setup time. Larger halls frequently have a convenient provision for power hook-up that is isolated from the lighting circuits (a familiar source of electrical noise in audio), and are aware of the cabling re-

The audio section of One Pass' video production vehicle features a 24-input Auditronics model 700 console, an Otari MX-5050 2-track and various outboard signal processors. For music-recording dates, a 24-track can be hired in from an outside rental company.



quirements of remote trucks.

The myriad of audio and video multiway snakes need to be routed away from potential sources of electrical interference, while avoiding the possibility of damage from equipment dollies or forklifts. The length of the audio cable should be minimized to maintain the best signal quality.

While discussing your show with the stage manager, you might receive a good recommendation for a truck, since he probably has experience with several different companies.

There are several other sources of referrals available. Although the published directories are helpful, they don't always provide the information you're looking for. The information may be outof-date, and the apparent number of competing rigs is probably misleading, because some companies offering remote services are actually consultants that will represent you to their favorite independent truck. However, a consultant may be the best approach to your project, because he makes the effort to know the current marketplace.

If you elect to go shopping directly, seek out some recommendations from musicians, producers and engineers. Check out the credits listed on your favorite albums and video concerts. Recording studios in the area can also help in locating viable choices.

In reality, there are very few fully equipped remote trucks, and their business image is fairly low-key. Most of their business comes from word-ofmouth promotion.

Evaluating mobile operators

Assuming that you now have the names and phone numbers of some potential suppliers, let me offer some suggestions on the best way to evaluate the merits of each of them. Choosing a remote company is similar to choosing a studio, except that distance often may make it difficult to actually visit the facility and meet the key people.

You'll find several varieties of equipment lists and vehicles. Depending upon your specific requirements, you can concentrate on fewer candidates by knowing their basic qualifications. The vehicles fall into four categories:

- Strictly portable equipment.
- Vans or straight-trucks.
- Converted buses or motor homes.
- Tractor-trailer rigs.

Either the budget or specific event location may eliminate some choices. Portable equipment is most often used in orchestral recording, although there are certainly other situations where the portable approach is sufficient. I know of one highly respected remote company that is


Sectional view of the GHL mobile showing (from left to right): the rear cable storage area and reels, audio control room equipped with 36-input Harrison MR-4 console with Sound Workshop ARMS automation, Cipher Softtouch time code synchronizer, Lexicon and Quantec digital reverbs, Marshall Time Modulator, Eventide Harmonizer, Valley People, Aphex, UREI and dbx compressors, Fostex LS-3 monitors, two Otari MTR-90 multitracks, two Otrai MX-5050 2-tracks and an MTR-12 2/4-track, and a rear maintenance shop and production lounge.

setting up four, 2-inch machines and a 70-input console for a 46-track remote in Africa; obviously, something of this complexity represents an exceptionally portable system.

If you elect to contract a company using such equipment, it will need access to a suitable space at the hall to set up the control room.

Most mainstream remote recording, however, involves too much equipment to be easily transported separately, and it is permanently installed in a truck or bus. It goes without saying that larger vehicles are more costly to construct, transport and operate, and require parking space at the hall. They offer the advantages, however, of ensuring quick set-up, consistent monitoring and isolation from the sound in the hall.

The recording formats available for remote recordings are variations on several familiar categories:

· 2-track stereo (direct-mix).

• Narrow-gauge multitrack (8-track on ½-inch; 16-track on 1-inch).

• Single multitrack (16- or 24-track on 2-inch).

• Dual multitrack (46-track or continuous recording).

Some mobile trucks are carrying digital stereo or multitrack machines, and most can rent them for an additional fee. The main advantage of the dual-machine approach is the ability to continuously record a live session without having to change tape reels.

You should check out how many console inputs will be needed, as well as how



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many signals need to be shared with the stage. Many times, additional mixing inputs can be provided by satellite boards to submix less critical sources. Don't forget to include adequate micing of the audience, and extra console inputs provide a measure of security against surprises and failures.

Because there may be many surprises at the gig, you should also have confidence in the technical integrity of the overall system. Power conditioning, grounding immunity to RF interference and, in particular, the type of interface to stage and house equipment or video truck may seriously affect your project. Usually, a remote audio truck is isolated via transformers and balanced audio lines from all other on-site equipment grounds. The better rigs have several options that can cure most problems.

Microphones and monitoring

In order to evaluate the number and types of microphones to be used to record the live date, remember that most critical mics will be electrically split with the PA or sound reinforcement system. The artist and his sound contractor will be active in the selection process. You need to identify which console will supply phanfom power to the condenser mics and active direct boxes. During the setup and recording, any repatching of powered mics must be coordinated by the mixing engineers, or there will be transient "kabooms" and power transients sent to the other consoles. Any house or audience micing, however, is usually isolated and unique to the recording truck.

Check to see that the internal layout of the control room area is workable for your engineering style. There are as many design approaches for monitor systems and equipment location as there are remote trucks. Some facilities are best suited only for recording, while others can be utilized as post-production or mixdown rooms.

When you have sufficient time to evaluate the monitoring system, bring along a familiar source on tape or CD. If the main system sounds too unfamiliar, you can also operate with a smaller, close-field monitor system mounted on the console.

If your project involves video or film, make sure that the audio equipment fulfills the appropriate requirements. An experienced technical advisor may be needed to coordinate the efforts of the video and audio staff to ensure proper synchronizing and editing during postproduction.

Perhaps the most important factor to consider is the area of personnel. Remote audio is vastly different than studio sessions. Because there is little time to develop a rapport with the various technical crews, a cooperative attitude is essential. Whoever is actually mixing the show must be experienced in remote work. If you are planning to use an engineer from outside the remote company's staff, make sure that the latter is amendable to a free-lancer. The chosen engineer must know his primary tasks as they relate to the final goals.

For instance, if the show is to be re-

mixed later for an album release, the stereo monitor mix can be compromised in favor of cutting great tracks. The intensity and concentration might cause the average studio engineer to behave irrationally.

Most remote audio trucks are built by an engineering entrepreneur; try to obtain his or her presence at your gig, even if he is only there to "baby-sit" your mix engineer.

Audio production staff

A typical remote session requires three crew members. An on-stage assistant, who is always available via intercom, maintains the truck-to-stage interface, and is ready to assist if problems develop. The mixing engineer will be thoroughly pre-occupied with the console(s). The tape-machine operator runs the 2-track and multitrack transports, changes reels and usually keeps a detailed log of any information that may be helpful during post-production sessions.

More or less people may be involved in a given show, depending on many other factors. Music festivals are perhaps the most difficult to handle, because the stage setup is constantly changing. A live recording or broadcast of a festival requires extra knowledgeable people on stage, keeping the various mixing engineers updated on input assignments, and maintaining constant vigilance on grounding/interface concerns.

Sometimes, however, too many helpers can be inefficient and difficult to coordinate. The optimum balance is achieved when everyone has a full-time but manageable task.

If you've made some calls and explored the areas I've mentioned, and still have more than one choice of facility available on the date in question, consider yourself fortunate. When obtaining bids, make sure that you've included all possible expenses:

Mileage and/or daily transportation fees. These range from virtually nothing for a local supplier, to perhaps \$1.50 per round-trip mile plus daily driver expenses and truck rental to your location.
Basic daily rates for the facility. As in all business, the more complete rigs are more expensive to rent.

• Travel, lodging and food expenses for the crew at the show.

• Additional equipment rentals, as needed.

Recording tape.

At first glance, the overall investment

is likely to seem large, but remember that, if all goes well, you will generate a lot of product in a short period of time.

The following ideas might increase your cost somewhat, while greatly decreasing your risk (remote recording is essentially risky):

• If at all possible, schedule the key people to attend a show prior to the recording. This is impossible in the case of special events, but any familiarity with the staging and music helps tremendously.

• If scheduling permits, a setup day and/or rehearsal day is very valuable, and usually less expensive to book than a full recording day.

• And finally, don't skimp on the tape budget. In the final tally, recording tape is probably your cheapest insurance. If the engineer is so concerned about tape usage that he misses a spontaneous intro, you may spend hundreds of dollars to repair it later.

For those of us who mix both in studio and trucks, remote dates are seldom routine. While we thoroughly enjoy a well-produced studio album, remote audio engineers find nothing to compare with the impact of a live performance.

R·E/P



Production Viewpoint:



Wendy Carlos, composer/synthesist, in her MIDI equipped personal-use studio.

Wendy Carlos

By Amy Ziffer

From the release in 1968 of *Switched-On Bach*, through a variety of innovative albums and film scores to her latest offering, *Beauty in the Beast*, this prolific producer/musician has demonstrated that synthesizers and electronic music offer the composer an enhanced palette of sound textures and colors.

M any consider Wendy Carlos to be a leading pioneer of electronic-music composition, and possibly the first person to truly popularize and legitimize the use of synthesizers and synthesized sound. Over the course of a long recording career, which began in 1968 with the release of *Switched-On Bach*, and continues with her most recent work, *Beauty in the Beast*, she has consistently charted new musical territory. Her new project, a series of original pieces that experiment with alternate tunings and microtonality, it arguably the most innovative to date. **RE/P** caught up with the Grammy

A Los Angeles-based free-lance engineer, Amy Ziffer has a bachelor's degree in audio recording from the Berklee College of Music, Boston. Her recent sesslons include a variety of music and multimedia projects at Motown-Hitsville Studios, Hollywood. award-winning composer/synthesist between sessions at her Greenwich Village personal-use studio. With *Beauty in the Beast* receiving critical acclaim, our indepth interview began with the project's conception.

RE/P (Amy Ziffer): Beauty in the Beast has been a long time in the making. When did you start work on the project? **Wendy Carlos:** Several years ago, at least. In many ways, I've been working on it, on and off, probably the better part of the past two decades. There was an inevitability to this particular record, not that it's the only thing I have to say on the subject of possible timbre and tunings—but this was the first time many parallel paths in music and technology came together. Not just for me in my career, but I felt for the whole industry, the whole world, and it's just a quick snapshot of that intersection. As I was working on *Beauty in the Beast*, I felt that it was probably the most important record of my career.

RE/P: How did you develop the unusual and alternate tunings used on Beauty in the Beast?

WC: Back in 1955 or 1956, at about the same time the RCA music synthesizer came to the public's attention, I was reading books on tunings and temperaments. The ones I used on *Beauty in the Beast* grew out of a lifelong awareness of what a lot of other people had done before me. Each of them has a different history; they vary all the way from "I stole it," to "I just sort of invented

it"—the latter based on ideas that have been around for years and years.

I stumbled across a few myself by happy accidents, some were taken from ethnic ideas developed by many cultures over many hundreds of years, and were ideas that came about while tinkering in the studio.

RE/P: On the liner notes for Beauty in the Beast, you mention a scale you used in the title cut, called Alpha. How is this Alpha scale constructed?

As I was working on Beauty in the Beast, I felt that it was probably the most important record of my career.

WC: There is a property of equal temperament that's desirable in and of itself. The symmetry of always having the same size intervals available (equal tempered scale) is musically fascinating, even if it has no acoustical foundation whatsoever. I thought. "Let me see if I can find a scale that has some pure intervals, but also equal-sized steps."

I built a scale in which I took the size of the minor third, split it into four parts and then stacked up as many of those parts as I could within the octave. It turns out that when you do that, by luck, after repeating five more of these steps (from the minor third), you hit a perfect fifth within such a close tolerance it sounds far better than the equal-tempered scale.

Because we now have the minor third within the fifth, we should then expect to be able to play a major triad. In this way, you have a way of playing a triad that's purer than in any of the tempered scales I'm aware of. But you also have this strange ability to play melodies in this interval that exactly splits a minor third. The Alpha scale lets you create harmonies very smoothly and yet makes your melody very exotic.

Unfortunately, if you keep going with these steps, when you have almost reached an octave, you're just a mite flat. And, when you take the next step. you overshoot the octave—so there is no octave in the scale.

This property gave the album its title because, at that time, I called (the Alpha scale) "the beast"—and hence "beauty in the beast," thinking how beastly this idea was of not having an octave interval. Yet

listen to how beautiful the sounds are on the album.

RE/P: Have you ever experimented with polytonality or atonality?

WC: On a new record that'll be out this spring, called *Secrets of Synthesis*, which is my homage to the whole field, and to all of the people who helped me get where I am, I demonstrate a scale that is 13 equal-sized steps in an octave. And that's exactly the right scale to use if you want to fool around with atonal music.

"Just Imaginings," a cut off *Beauty in* the Beast, has polytonality all over the place. I started out by imitating a type of texture that piles together many tonalities all at one time. I was curious to know what it would sound like if those tonalities were not tempered the way that ours are, but tuned to the just intervals of what I call the "harmonic scale." The answer is that it sounds lovely.

I much prefer the sound of polytonality when the notes are tuned properly, in just ratios. It looks like polytonality and bitonality are at home in the new world of being able to tune things correctly.

RE/P: On Beauty in the Beast, as well as previous studio projects, you've taken on the duties of engineer and producer, as well as composer and performer. When did you start handling engineering duties? WC: The first exposure I had to recording was back in high school when I put together a film with an 8mm movie camera and a 1/4-inch tape machine, and discovered that the two could be made to stay in sync if you did a lot of editing. In college at Brown University I met this fellow who, at the time, was running the only professional remote recording facility in Rhode Island, and he asked if I would help. I learned to set up microphones and run the Ampex tape machines

Then I went to Columbia-Princeton Electronic Music Center. In those days, doing electronic music, there was no way you could not pick up an awful lot of "polish" in recording and editing. After I left, I got a job at a studio in New York that no longer exists, called Gotham Recording. Gotham hired me on the basis of the fact that I was among the fastest people they had ever seen editing. The tape I had to put together every day would usually take me about half my 8-hour shift, and then I could play around with the equipment.

RE/P: As well as having a hand in practically every aspect of the album's realization, did you also become involved with the mastering stages? **WC:** Oh, I do all that! I'm like a 1-person band. Mastering to digital, as I do, you

soon discover that you're spoiled by digital's wide dynamic and low noise. When you then come to cut the LP and cassette (loop-bin master) versions, you have to go back to limiting the dynamic range a little bit. I did the level adjustments by hand. I did not want to use a limiter or compressor, so I just rode the fader gently throughout the whole remastering stage.

RE/**P**: Do you have an overall philosophy of recording and production?

If I did use sampling it would be as a tool for editing and putting together a piece.

WC: I try not to be too habit-bound; I'm always stopping myself from falling into too many patterns. Of course, in the recording studio when you're talking about good, sensible practice, there are some habits that are good to keep, such as using reasonable levels. For synthesizer work, I've always found that it's best for me to put the full performance value on the tracks, so that I'm not having to do much more than look after the overall balance in the mix. Later on, you can never put in the interpretation that you've missed doing while you're playing.

RE/P: Do you find that your compositions maintain their integrity in the transfer from an idea to the master tape, or does multitrack and the ability to hear things at various stages of completion become a form of inspiration in itself, and give you new ideas?

WC: This is the first project that I did not write out first on score paper. Usually that is where you put your ideas down, and discover if a composition has a mind of its own. The kind of thing you're talking about is something I've encountered before. When it happens on a recording, it's for very different reasons. For an example, you hear sounds that are bigger and fatter, so they want to go at a slower tempo.

You receive all kinds of feedback when you're recording and that definitely influences the overall piece. The ideal is to leave yourself open to make a change when you realize you need one, and to throw away wonderful minutes of music when they just don't belong there.

Table 1. Mathematical origins of the chroma or well-tempered scale, based on the common use of A = 440Hz.

Note	Frequency (Hz)	Difference of frequencies	Ratio of frequencies		
A	880.0	(880.0 - 830.6) = 49.4	$\frac{880.0}{12}$ = $12\sqrt{2}$		
G#	830.6	(830.6 - 783.9) = 46.7	$\frac{830.6}{830.6} = {}^{12}\sqrt{2}$		
G	783.9		783.9		
•					
•	•				
Ċ	523.3	(523.3 - 493.9) = 29.4	$\frac{523.3}{2}$ = $12\sqrt{2}$		
В	493.9	(493.9 - 466.2) = 27.7	$\frac{493.9}{493.9} = {}^{12}\sqrt{2}$		
A#	466.2	(466.2 - 440.0) = 26.2	466.2 466.2 = $12\sqrt{2}$		
A	440.0		440.0		

For *Beauty in the Beast* I threw away probably three or four album's worth of music, because it just didn't work. I allowed myself to take lucky things that would happen in an improvisational way and make them become part of the composition.

RE/P: Did you take an active role in the design of your personal-use studio?

WC: I guess I did all of it myself. Originally, I had a lot of input from a design engineer who helped me put together the plans. Of course, it's undergone so many modifications now that it's considerably different from the original.

I've got it to the point where the (custom) console has about as wide a signal-to-noise ratio as is theoretically possible, probably something like 115dB. It was last rebuilt just a year ago, and is now as quiet as anything out there.

The room was built as a Faraday cage,

The Mathematics of Alternate Tuning Scales

A common misconception we have about Western music is the belief that the way in which instruments are tuned is the way they have always been tuned. This is untrue. In fact, up until roughly 250 years ago, many conflicting tuning methods were simultaneously in use throughout Europe. The changing needs and desires of composers, however, result in the invention and standardization of the scale commonly used today.

The two most essential features of our chromatic scale, often referred to as the well-tempered or equaltempered scale, are:

• Its division into exactly 12 semitones; and

• The absolutely constant size of the interval between any two successive notes, no matter which notes or which register are selected.

The first feature is usually easily understood; the second is not so simple, however. From Table 1, it can be seen that, although the difference in the frequencies of any note and its immediate predecessor will vary, the ratios of these frequencies is a constant value equal to the 12th root of 2, also written $1^2\sqrt{2}$ (approximately 1.05946).

What this means for composers is that when they modulate from one key to another, they can be confident that there won't be any unpleasant harmonic problems due to differences in the size of intervals. In other words, a perfect fifth is a perfect fifth, no matter which key you're in or which key you decide to move to; the same applies to minor thirds, and any other interval that can occur.

So why, you might ask, if it makes so much sense, wasn't this well-tempered scale in use all along? Here's where things get sticky. If you think back to your high-school physics classes, you'll remember Pythagoras' experiments with vibrating strings. Picture a guitar string, say the low E, set into motion by plucking; not only is E produced, but also various overtones. (Overtones are notes whose frequencies are whole number multiples of the fundamental.)

It just so happens that the interval of the fifth that is produced as a natural consequence of this series of overtones (hence, the expression a "perfect" fifth), is not the same as the fifth in the equal-tempered scale. Although minute, the difference is but audible. It is compounded if you attempt to tune an instrument with real perfect fifths throughout its range.

The importance of the fifth in relation to the fundamental is beyond the scope of this explanation. Suffice it to say that if we desire acoustically accurate intervals, we have to scrap the ability to modulate freely, and vice versa. Over the course of Western music, the need to modulate won out.

A scale with acoustically correct intervals is called a just scale. Another scale in use in the past that tried to resolve this conflict slightly differently is the mean-tone scale.

Microtonality refers to the use of

notes whose frequencies fall between those of the well- or equal-tempered scale. There are many ways to devise such scales, and they do not necessarily have to have constant sized intervals. Of course, other cultures have dealt with the problems and possibilities of tunings in myriad different ways, some of which can be heard on Wendy Carlos' Beauty in the Beast.

By way of an example, the line notes for Beauty in the Beast provide the following explanation of the Alpha and Beta scales used on the title track:

"The new scales used for [blending two quasi-grotesque ideas with a romantic theme] are quite odd. The first .heard, called Beta, splits the perfect fourth into two equal parts (actually eight equal steps of nearly 64 cents each), and the second, Alpha, does the same to the minor third (four equal steps for 78 cents each). While both scales have nearly perfect triads (two remarkable coincidences), neither can build a standard diatonic scale, and so the melodic motion is strange and exotic."

Another track, "Just Imaginings," is described as being "perfectly tuned in a Super-Just scale that the composer refers to as Harmonic scale. It continues past the fifth harmonic of just intonation all the way to the (prime) 19th. "And then," Carlos continues, "in a 144 note per octave slight of hand, it modulates all over, including two circles of fifths, at the climax to sections one and three." and is shielded from all of the New York broadcast signals. We used Sheetrock with foil backing, and screwed it together onto a galvanized steel track so that the metal foil touches the metal track; the carpet is covering more aluminum screening. All of these are tied together, so the whole room is a conductive cage.

The grounding star point on the console is a penny, and everything grounds to that. There's been times when we've grounded the shield to the star point, but I think right now that the room is floating on the inside and the shield is grounded.

The best test is that when we put a radio or television in there, we get the lousiest reception in the world!

RE/P: What kind of synthesizers and recording equipment are you now using? **WC:** I always laugh at interviews where they ask "What box do you use?" They just talk about what boxes they own. Who cares? So I use a Stanley screwdriver and this guy uses a Sears and Roebuck screwdriver. Does it really matter?

I've got tape machines, a console, equalizers, echo chambers and digital delays—the units everyone else is using. I've been using the Sony PCM-F1/701 (EIAJ) digital format and some of the fancy Sony Betamax VCRs. I've still got an Ampex 2-track, a 3M 4-track and a 3M 16-track with a rebuilt set of Dolby A301 cards, which I'm now going to replace with SR cards.

I've never used 24-track because of the narrow track widths—43 mils is just too narrow. *Beauty in the Beast* was tracked to 16-track and then mixed down to digital, so there was one analog pass. But the sounds, not having been sampled, have no microphone limitations.

I'm looking forward to getting a really fine MIDI sequencer that can edit easily and take variable tempo and meter. I also want to see Macintosh software equipment for dumping music sequences onto score paper, so that you can read notes on a page.

I'm impatient about a lot of things and those, I think, are the important pieces of gear—ones that I wish I had but don't!

RE/P: What role did your engineer, Stoney Stockell, play in the project? **WC:** I've never really given Stoney adequate credit. He is a very good programmer, and he knows how to put the hardware together. Without him I would not be at this stage—it's that simple. He and a friend are now marketing something they call the Mulogix Slave 32, because it has 32 oscillators and can be slowed to a MIDI keyboard. They're Betatesting it now. It will provide R&D feedback for more important products.

My friends at the AES are trying to twist my arm to come down to Los Angeles in May to give a talk at the Computer Music Conference. If they twist my arm hard enough, I'll probably come with my Slave 32 to demonstrate sounds and tunings. [The AES conference on "Music and Digital Technology" will be held May 1-3 in Los Angeles. See page 8 for more details—Editor.]

RE/P: How did you deal with the problem of playing a keyboard devised for equal temperament scales, but which is used to control altered tunings?

WC: I have a 16-bit Hewlett-Packard 9825, for which I wrote software that allows me to tune the Synergy [synthesizer]. I have another set of software that allows me to call up the tuning tables by just pushing one key, but that was truly horrible.

After 1 finished the record in 1986, 1 took an old keyboard I had that was one octave long and turned it into one that

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could control the Hewlett-Packard. It took me a couple of months to do, but I finally found a way so that when I pushed C it said to the Hewlett-Packard: "OK, send to the Synergy the tables for C." If I do it quickly before I play my first note in the new key, it immediately dumps in the new tuning.

The truth is that, with some of these new elaborate tunings I'm fooling with now, it's a very frustrating process. It's

On some of the tracks for Beauty in the Beast I did use the onboard sequencer that is part of Synergy.

not a sufficient answer, but that's what happens when you follow your nose looking for something new and exciting.

When I was trying to build a digital synthesizer in the late Seventies, I was pretty much working in the dark. Hal Alles, the fellow at Bell Labs who designed the digital oscillator card that forms the heart of the Synergy, built seven synthesizers before he arrived at the final one. Even the Synergy architecture has a lot of frustrating things about it. I'd like to be able to microtune the partials with a better resolution than they've given me.

Kurzweil sent me K150 to play with. Once again, they've overlooked certain things. They do not allow you to move the overtones by ramping them in frequency during the time of a note. That's how acoustic instruments sound so rich. Hal Alles' card did not have that problem; he didn't know what was important so he gave everything equal value.

I know enough technically to ask the right questions, and usually the answers that you get are not very satisfactory: "No one needs that," "Oh, that's not important," "Well, nobody can hear that" that one's used a lot, and of course it's not true.

But who wants to be the one to decide how these things should be done? Years from now people are going to look back at those of us who are setting down the standards now and ask, "Why didn't you think of doing this or that?" And we'll have to say "I don't know. I just didn't think of it!"

RE/P: You seem to have a fascination

for combining old and new; natural with man-made. What do you think about the use of synthesizers to duplicate the sounds of traditional acoustic instruments?

WC: It's probably the only way that you're ever going to learn to do anything. I think a good artist learns perspective, shading and color balancing, and may even try and learn to imitate a photoghraph. When they're finished learning, they don't try and do that for their career. They've got the tools now under their belt, those tools can then be used for anything. But if you don't spend the time paying your dues, you don't have the ability.

RE/P: You seldom hear synthesizers being used solely for their unique capability, to achieve sounds that an acoustic instrument will never produce.

WC: I agree. It's like buying a fancy wood-working set and then only using it to shorten the legs of a chair. It seems like a waste of the tools.

I think that you're best off taking the bull by the horns and saying: "If I'm going to do it, I'm going to do it right. I'm going to learn to play chords, harmony and melody, to get good chops on the keyboard or whatever controller, and I'm going to learn to make all of these really sophisticated timbres other people have developed over the years...like a Stradivarius violin. Learn what makes it sound good, and you'll be better off.

RE/P: Do you think it's only a matter of time before composers and synthesists become used to the new tools, and the field of electronic music really begins to flower?

WC: Perhaps, but don't forget Theodore Sturgeon, the science fiction author, whose rule for the world was, "95% of everything is crud." That includes composers and the music they write, plus the synthesizers they use.

Later on it's all very well and good to say "We've got Beethoven and Mozart," but what about those other composers we've forgotten? Without that reflection of mediocrity around us, we would not know how to take the steps to move forward and try to be a little better.

RE/P: On your new album you state that none of the sounds were generated using sampling technology. Do you see yourself working with sampling in the future?

WC: Not the way everyone else is using it. It's not good enough for me to just capture something—I have to know why I'm sampling it. I always wanted to build my own rather than take in something that has been prebuilt for me. If I were to choose between being a photographer and a painter, I would pick the latter. But it takes a lot longer; you can take more pictures in your life with a camera than you can ever hope to paint. It's a slower way of working, but you can then come up with things that don't already exist.

If I did use sampling it would be as a tool for editing and putting together a piece. But it wouldn't be because that's the way I'm actually going to make my timbres.

I am going to do a modern version of Switched-On Bach, using new technologies as a farewell gesture to J.S. Bach.

RE/P: Do you use sequencers?

WC: No, I have always played live. The newer devices called sequencers are more like digital recorders of performance gestures. On some of the tracks for *Beauty in the Beast* I did use the onboard sequencer that is part of Synergy. It can play about 1,000 notes. I used it to play little patterns at times when I could not push the record button at the same time as hitting the computer keyboard to alter the key and play the notes. I kept blowing it and finally just taught myself how to use the sequencer.

RE/P: How did you become involved with the music scores for A Clockwork Orange, The Shining and Tron?

WC: I had written some music that I thought would be right for A Clockwork Orange, so we sent Stanley Kubrick lots of tapes. He asked if we could fly out to see him [in London] and we then discovered that the music was already laid into the movie and he was getting used to it. It was essentially a matter of finishing the job.

Then, in 1978, he called us for *The Shining*. For various reasons, very little of our music—I think we had composed about seven or eight hours when we were done—managed to make its way into the movie.

Nonetheless, because of these two film scores and my records, Michael Fremmer, who was working with Disney on *Tron*, called up and wanted to know if 1 would do some synthesizer music for that score. I told him I'd only do it if I could also do the orchestral portions. "You can write for orchestra, too?" he says, to which I reply "Are you kidding?" I sent them some music, they loved it and I got the job.

RE/P: You were once quoted as expressing "a desire to make electronic music as much a performing art as possible." Have you intentionally shied away from touring and live performance?

WC: No, not at all. I do lecture tours and demonstrations. I've been dying to find somebody who would sponsor a concert of traditional and new music, using about a dozen people playing Synergy-like machines. I'd be interested if I could do it on that basis, but not to do it badly. To gather an ensemble of people to do polyphonic, contrapuntal music that has the same interest as a good jazz combo or an orchestra would be very interesting.

RE/P: Having moved out into a totally new direction with Beauty in the Beast, what can we expect to see from Wendy Carlos in the future?

WC: It looks like that, for commercial reasons, I'm going to have to do a few more performances of other peoples' music once again, which is a bargain with the devil I've never been able to totally get free of. Certainly everyone more

has been pulling my collar and saying, "Hey Wendy, you've got to do a 20th anniversary record for this *Switched-On Bach* thing." I am going to do a modern version of *Switched-On Bach*, using all of the new technologies as a sort of farewell gesture to J.S. Bach, who certainly did a lot of favors for me posthumously.

If I can ever reach the point where I get enough success with my original compositions that I can pursue more of the same, I want to work with some singers and use some of the newest devices, like the Fairlight Voicetracker. That will allow me to convert pitch into MIDI data from any instrument or voice, dump it into a MIDI sequencer and play it back on a synthesizer to meld true vocal music with all the things I can do now.

I think as soon as people get bored with their sampling devices and analog instruments, they'll learn the same thing I was forced to; namely that you've got to be able to draw any possible picture if you want to know that, in the future, you will never run out of ideas. The truth is that we're in a time of growing pains, with MIDI being set up and hardware being decided on. I think in another 10 to 20 years, things are going to be a little more cut and dried.

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Take for example, alternative tunings: I'm sure in a matter of years that will be old hat; right now though, it's pioneer territory. Although we live in exciting times. I always remind myself of a Chinese curse: "May you live in interesting times."

Alternate tunings will change the style of the music we make. It won't happen in our lifetimes, but gradually people will begin to learn to accept a broader "palette" of scales and types of music—it will become more eclectic. I think that we'll see a marvelous renaissance, in music and in all the performing arts.



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Independent Production Contracts

By Rosanne Soifer

An independent engineer or producer contemplating a spec deal should carefully check the small print in the production contract. For the unwary, the process can be costly but negotiated correctly, spec dealings can be profitable and lead to more lucrative sessions.

Jobs without money have become a way of life in some parts of the music business. Working on spec, bartering one's talents and playing showcases are three common format changes that have largely superceded receiving normal legal tender for a day's (or night's) work.

For an intertwined variety of social, economic and technological reasons, the music business ain't what it used to be—if it ever was. Speculative work for independent engineers and producers, studios, side musicians and editors exist for anyone willing to forego immediate (cash) gratification for a larger piece of the pie at a later date.

"There's no real budget in spec," says Michel Sauvage, manager of Sound Ideas, New York. He served six-and-ahalf years as manager of Electric Lady in New York, produced albums for Roy Buchanan, and has handled engineering duties for Cameo, and King Creole and The Coconuts. Sauvage has experienced spec work from all angles.

"If you pay anyone up front, except for out-of-pocket expenses and extra studio personnel who aren't really in on the project, it causes problems," he says. "Also, any and all future work arising from the original deal must be taken into account with a time limit, which may vary according to the venue and the style of music.

"Why? Engineer/producers have to be careful that the artist doesn't at some point back-date your agreement once he Rosanne Soifer is a New York-based free-lance technical writer. gets signed to a major label. That lets both him and the label off the hook regarding any prior obligations. But, personally, I have to feel good about the people and talent involved before committing any of my time."

Another independent who agrees with Sauvage's philosophy is Eumir Deodato, who, having produced several Kool and the Gang ablums, also has had several hits as an artist. He produced the Roberta Flack selection from the movie White Nights, as well as One Way, whose single Don't Think About it saw chart success.

"The song must be there; that's the most important factor," Deodato says. "I'll turn down a spec deal—even though the artist is good—if the material I'm sup-

Contract Basics

An independent production contract should cover the following topics: • Quality control of material, musi-

cians and choice of studio. • Time for the producer to prepare the demo, perhaps with an option to renew

- Mutual final selection of material.
- Storage and custody of the master tape.
- Right of assignment.
- Condition of royalties.
- Protection of the artist's original material.
- Standard definitions of recording costs.
- · Override provisions.

posed to work with is mediocre."

Although a producer, understandably, wants a contract that gives him a decent percentage of the future deal, Deodato is more specific.

"I'd go for an escalating percentage of record sales as the sales improve," he says. "You make an exception in the case of a new act, where going for a flat percentage is smarter, since you don't know if the record will bomb or not.

"I wouldn't put in for points from all the artist's revenue (such as live performances) once he gets signed. That gets into the realm of management. It's dangerous for a producer to be involved with that aspect and you make a lot of enemies that way.

"Restrict any other points to production and maybe publishing, if applicable. It's also not the producer's job to shop the tape; it's exhausting and often hard to tell in retrospect who did what that got the act signed."

An independent producer negotiates with the artist or the artist's management. Contract provisions might cover the following areas: quality control (of material, musicians and choice of studio); time for the producer to prepare the demo, perhaps with an option to renew; mutual final selection of material; storage and custody of the master tape; right of assignment; condition of royalties; protection of the artist's original material; standard definitions of recording costs; and override provisions.

Independent engineer/producer Mallory Earl recently worked with Independent producer and Sound Ideas studio manager, Michel Sauvage.



Madonna's first band, Breakfast Club.

"There are two major kinds of spec deals," he says. "The first is when the producer is approached by an unsigned act; and the second is when the producer himself approaches an act and offers to produce in order to get the things he needs—like equipment or studio time—in sort of a barter."

The first type of deal is probably the most common, Earl says.

"The producer may be specing his time and services, or he may be financing the production, but not necessarily the band. If the producer is working on spec," Earl says, "his agreement should state that he will be entitled to at least 25% of the label deal when the band is sold.

"The 'deal' means the total sum: advances, production expenses and royalties. Points on retail sales vary and should be negotiated separately.

"Another way is to ask for a dollar amount and a lower percentage, or for an additional 25% of the deal for specing his time, as sort of a finance charge. Plus, I feel the producer should have the power of assignment of the band to a third party, be it any party who can manufacture and distribute the product in any way."

The recording studio's role

Engineer/producers are usually amenable to spec deals because, to be honest, it's how most of them start out and continue to stay active in the recording business. However, studio owners tend to regard spec deals the way most people contemplate back surgery—an expensive inconvenience that may or may not bode well for the future. And because most deals tend to involve the unmonied, the unknown and the unsigned, such concerns are not frivolous. Yet, many studios handle sufficient spec work to warrant creating special spec contracts. A brand new studio that starts out by taking in spec work thinking it will soon pay off and/or bring in paying clients—is usually in for a rude awakening.

After all, a new studio tends to attract attention from fledgling artists whose friends are equally broke. In the meantime, a studio owner might wonder, "How will you pay the phone bills?"

That's why, says Steve Simenowitz. Long Island-based entertainment lawyer, many established studio owners hang up the phone when they hear the word mentioned. That's also why many established studios become involved with spec work to fill time the facility cannot sell otherwise.

The key factor in a studio's decision to become involved with a spec deal centers around what Simenowitz refers to as "opportunity cost."

"This economic concept estimates the value of a project not by its intrinsic costs," he explains, "but substitution costs."

In others words, would the time a studio gives to a spec deal be considered down time anyway, or would it be time that studio would have no trouble selling to a paying client at card rate?

This decision may depend on just who

"If you pay anyone up front, except for out-ofpocket expenses and extra studio personnel who aren't really in on the project, it causes problems."

Michel Sauvage, studio manager, Sound Ideas Studio, New York

the person seeking a spec deal is. According to Sauvage. "For a beginning artist, the studio may insist that a spec deal be in full force and effect for a certain amount of time for anything the artist accomplishes, in addition to the tape he recorded there.

"For example, if artist X is still shopping the tape he made at the studio but, in the meantime, has met people hanging out at the studio, put together a road



band and has started making some money as an opening act, the studio management may insist on a piece of the artist's profits.

"The spec contract artist X made with the studio, therefore, is not only for the demo tape, but also for whatever else he does musically within the specified time frame," says Sauvage.

This may sound a lot like owing your life to the company store, and may provide artist X with about as much breathing space as a new pair of jeans. However, Sauvage makes the point that a neophyte without management is "learning simply by recording and hanging out at a top-notch studio." Future monetary success within the specified time frame may indeed be directly traceable to the spec time the studio invested in artist X.

Hours in the studio

A generic spec deal permits an artist to record for a maximum number of hours in a studio. If the artist secures a label deal, the studio must be paid back at card rate, and the subsequent album must be cut there. If, for some reason, it cannot be worked out that way—maybe the label specifies that the album be cut at another facility—the studio must be paid back at usually twice the card rate.

The figure represents costs for session time. Most spec contracts, whether between the artist and the independent producer or the studio, contain other clauses that provide the latter with many possible money making opportunities at the artist's expense.

A cursory glance at the 15-clause. 4-page contract drawn up by a major New York studio bears this out. Buried within the expected terms and conditions concerning payment schedules and time constraints, the contract contains phraseology which, among other things, gives the studio the right to pre-empt the artist's session with no advance notice (otherwise known as bumpability); the publishing rights for material recorded until the artist secures a label deal; the right to assign the agreement to a third party, including perhaps new studio owners; and also the right of the studio to seek injunctive relief should the artist breach the agreement in any way.

Spec work is obviously very future oriented, because nobody gets paid at first, if at all. When the deal involves video, it may take on some interesting twists for both the studio and the indy producer.

According to Tom MacDonnell, one of the owners of East Coast Video. New York, "Doing a video on spec really means the studio is doing it as a freebie, since a record company will usually be interested in the artist's video only as a prelude to signing the artist for an album. The video, therefore, becomes a selfcontained promotional item for another product.

"How then can the studio determine its rightful cut on an album that hasn't even been planned yet? The only alternative

"I'll turn down a spec deal—even though the artist is good—if the material I'm supposed to work with is mediocre." Eumir Deodato, independent producer

seems to be to go for total reimbursement for the video at card rate, should the artist get signed as result of it. This isn't really on spec any more, but a 'buynow-pay-later' purchase plan."

The studio may do well to consider including a clause in the contract that provides for subsequent video taping should the act land a label.

Because of the conspicuous number of definite "maybes" involved, such as scheduling problems that leave everyone firmly implanted in midair, or potential investors with dubious financial honesty, many spec deals appear to be doomed to life on the shelf rather than the airwaves.

Here's an illustration of how and why; unfortunately, most of this story is true:

Mike Musician was one of those artists who more people had heard about than had actually heard perform. Although he had recorded fairly frequently in the past—both on his own and as a featured player on other artist's albums—he wasn't currently signed to a label. He and his manager approached the moneymen

Independent producer Eumir Deodato at his personal-use Duplex Sound studio.



behind Well Known Studio about a spec deal proposal.

Usually these deals are for 3-song tapes, but this was for a whole album. Because Musician had a name and had assembled some good session players as well as a producer with a good track record, Well Known said OK.

Well Known corralled their principal engineer and an assistant, and pulled together an agreement for both of them--also on spec. Musician's agent had publicized the project, so had Well Known Studio. Several labels had expressed interest. What could go wrong?

The project was a musical disaster and was shelved two-thirds complete. Musician was eventually signed to another label with a deal having nothing to do with the project, so neither Well Known or anyone involved could claim prior obligations.

However, nearly one year later, the principal engineer began to wonder about the project's demise, and asked Well Known to let him try his hand at finishing it, thereby superceding the original producer. Well Known gave permission. However, the engineer was still stuck with four songs written by the original producer. The project kept growing since new musicians had to be brought in to supplement the original tracks. Well Known was now owed about \$45,000-\$80,000 in session time alone.

After numerous attempts by the engineer (now the producer) to shop the tape, the most he could get was an offer of \$25,000. Therefore, the tape continues to sit on the shelf. Why?

If the tape is sold, Well Known will be presented with at least \$80,000 worth of claims. For Well Known to sell the tape for any less would open them to a barrage of lawsuits, including possible injunctive measures to prevent the tape's release. Can anything be done to move this tape off the shelf so Well Known can recoup its original investment?

Three possibilities come to mind:

• Mike Musician could suddenly become really hot on his new label, so that anything bearing his name—from records to roach repellent—would sell.

• Mike Musician could get involved in something—anything—that attracts and guarantees media attention (such as marrying someone notorious, getting arrested, or running for office).

• Mike Musician could die unexpectedly. (Death does well on the charts.)

With that last cheerful thought in mind, is it any wonder that many studios are reluctant to work on spec?

There are, however, some exceptions.

One is the jazz field, where spec is a way of life. It tends to involve everyone: the artist, studio, producers, side musicians and also the record label.

The second is with an artist who, although not a household name, has some sort of a following and, with the right tune, could very well hit it big. connection for all it's worth."

Accepting a non-event for what it is (or tuned out to be) can become automatic after a while. But, to avoid getting involved in what may turn out to be a bad situation down the road, means taking some elementary precautions.

"Before you get involved with an artist

"Before you get involved with an artist or sign anything, take a cassette of the material to your contacts in A&R at the big record companies, and find out if there's actually a market for the material."

> Mallory Earl, independent engineer/producer

Blues artists, "legends," members of well-known acts going solo, and musical theater performances, are good examples.

The last category is the artist or group attempting a comeback, such as the reactivated (1983) Mamas and Papas, featuring Spanky MacFarland. They recorded nearly a whole album on spec at Electric Lady, New York.

Low rung on the totem pole

While independent producers and studios may be able to demand various monetary pieces of the prospective pie without too much fuss, those further on down the line may have to fight a little harder, such as tape editors, assistants and side musicians. Now the credit line becomes essential, because there is no money to bank at the outset (which could be a long time; some "outsets" have been known to last several years). A credit line, however, may be bankable in terms of future work and, of course, must be insisted on, no matter what the other circumstances.

What if the project never goes anywhere? Suppose it gets shelved midway through, the artist/label/financial backers run out of money, or the studio folds? How does one make the best of (and get career mileage out of) a nonevent?

Free-lance tape editor and DJ, Gail Elise King, says, "Talk about it. Mention names you worked with and you stand a good chance of picking up paying jobs from it."

"The fact that a project died is not your fault," says Sauvage of Sound Ideas. "You did the work, you were employed—so to speak—for a measurable amount of time, and this is how you should present it.

"If you worked at a name studio with name people, play that up and use that or sign anything," says Mallory Earl, "take a cassette of the material to your contacts in A&R at the big record companies, and find out if there's actually a market for the material. Is there a targetable audience? And, if it's a band, be prepared for the fact that they might break up."

Yvonne Sewall, president of 1-Contact, a referral agency for independent engineers, producers and studios, echos Earl's sentiments.

"Before I negotiate a spec deal," she says, "whether I'm repping the producer or studio, I'm first interested in whether or not the artist has decent management with viable connections, and if the whole organization is well run. I'll even attend the rehearsals if I have to."

"Even if the project turns sour," says Eumir Deodato, "try your best to finish it, to avoid getting sued. Unless, that is, you can somehow prove that the screw-up is not your fault, and get out of it that way.

"I'd try to get a clause in my contract that gives me the right as producer to halt a project if I think it's going badly, or to pull out after a certain number of hours but still be owed for studio time.

It should be noted that Deodato owns Duplex Sound, New York, where most of his projects take place. Studio spec contracts are usually negotiated separately. Deodato also feels that a producer should specify in the contract that he be a mutual part of the final selection process of material.

Summing up the situation, Sauvage states, "I'd try to get a rider in my contract saying that my services as either an engineer or producer should be one of the first compensated when a deal is made."

All of which seems like sage advice to an independent engineer/producer contemplating a spec deal.

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Northeast

Magno Sound and Video (New York) has taken delivery of a Neve V series console with NECAM 96 servo-fader automation. "We handle sound rerecording, including audio sweetening and sound for TV features as well as theatrical releases," says Brian Bailey, Magno chief engineer.

"Then on the video side, we convert from European standards, and make duplications. The Neve V series enables you to use any module to be either an input or output bus, so you're not limited in any way." 212 W. 48th St., New York, NY 10036; 212-757-8855.

Production Masters (Pittsburgh, PA) recently upgraded its 24-track recording facility with the addition of a Boss time code editing system from Alpha Audio.

The editor and transport synchronizer system can be used to control a variety of sources in an audio suite, including tape machines, Compact Disc players and synthesizers. 321 First Ave., Pittsburgh, PA 15222; 412-281-8500.

Soundwave (Washington, DC) has remodeled and added a new Chips Davis, LEDE Design, studio and control room. Jim Harmon, founder and president says, "We're thrilled at the ability to bring the first Chips Davis designed facility to Washington, and know that the new Soundwave will offer producers and clients audio quality and an acoustic environment that is truly state of the art."

Harmon adds that all wall treatments conform to the principles of Live-End/ Dead-End. 2000 P. St., NW, Washington, DC; 202-861-0560.

At Howard Schwartz Recording (New York), John Alberts has joined the studio's engineering staff. Alberts was previously with Regent Sound Studios, New York, where he was senior mixer. His post-production credits include work for Saturday Night Live, Late Night with



David Letterman and Paul Simon's Hearts and Bones album. 420 Lexington Ave., *1934, New York, NY 10170; 212-687-4180.

Kajem Recording Studios (Gladwyne, PA) has added a Lexicon 480L digital reverb and effects processor, a Yamaha concert grand piano, an Ensoniq ESQ-1 synthesizer, an Aphex Compellor limiter and a Roland Dimension D effects processor. 1400 Mill Creek Road, Gladwyne, PA 19035; 215-MIX-EARS.

Power Play Studios (Long Island, New York) has added a **Sony PCM-3202** DASH-format digital 2-track and an **E-mu Systems SP-12** drum machine with disk drive. *38-12 30th St., Long Island City, NY 11101; 718-729-1780.*

Unique Recording (New York) has taken delivery of three Yamaha DX-7IIFD synthesizers, three Yamaha TX-81Z racks and an RX-5 digital drum machine with a total of 64 internal sounds. Oberheim hardware includes three DPX-1 sample players, a Sequential Prophet 2000 and an E-mu Systems Emulator II. 701 Seventh Ave., New York, NY 10036; 212-921-1711.

Southeast

Reflection Studio (Nashville) has added a Neve 8323 production console. 2741 Larmon Drive, Nashville, TN 37204; 615-269-0828.

Fry Systems (Arlington, VA), in cooperation with Time-Life Music, has purchased an AEG Telefunken M-21 analog 2-track for use during production of a Rock 'N' Roll Era anthology series. 1204 N. Sycamore St., Arlington, VA 22205.

At Ron Rose Productions (Tampa, FL), Deanna Everett has joined the staff as audio engineer. Everett previously worked as engineer at The Mix Place, New York. 3409 W. Lemon St., Tampa, FL 33609; 813-873-7700.

Middle Ear Studio (Miami), the Bee Gees' personal-use studio, has added a Neve V series console with NECAM 96 automation.

At Sixteenth Avenue Sound (Nashville), Dave Parker has joined the staff as audio engineer. Parker recently completed engineering training at the Full

Circle (36) on Rapid Facts Card

Sail Center for the Recording Arts, Orlando, FL. 1217 16th Ave., South, Nashville, TN 37212; 615-327-8787.

Masterfonics (Nashville) has added a mix room featuring acoustic design by **Tom Hidley** and monitor design by **Shio Kinoshita** and **Tom Hidley**. Hardware includes an **Otari DTR-900** PD-format digital 32-track and a **Solid State Logic SL4000** console. 280 Music Square East, Nashville, TN 37203; 615-327-4533.

Midwest

At Tele-Image (Dallas), Wayne Kirkwood has joined the staff as audio engineer. Previously, he served as field engineer with Solid State Logic in New York, where he was responsible for the maintenance, commissioning and system integration of new equipment. 6305 N. O'Connor Rd., Suite 103, LB*6, Irving, TX 75309-3510; 214-869-0060.

Discovery Systems, (Dublin, OH) has taken delivery of Neve 8232 console with 32 input modules and dual equalized stereo reverb/effects returns. 7007 Discovery Blvd., Dublin, OH 43017; 614-761-4138.

Reelsound Recording (Austin, TX) has added two **Yamaha SPX-90** effects, an **AMS RMX-16** digital reverb, a **Neumann U-67** mic and an **Audio Design** time code reader. 2304 Sheri Oaks Lane, Austin, TX 78748; 512-472-3325.

Southern California

Positive Audio (San Carlos, CA) has opened a new 2-studio facility. Studio B features a Harrison 32x48 automated console, two MCI JH-24 24-tracks, two MCI JH-110 2-tracks and an Otari MX-5050B. Computer, arranging and composition duties are covered with four E-mu Systems E-Max's and a New England Digital Synclavier II.

Studio A features a tunable recording room with a 16'x32' raised stage, a 65'x75' studio area and a **Steinway** concert grand piano. 1250 San Carlos Ave., San Carlos, CA 94070; 415-595-4041.

Micro Plant (Hollywood), a dedicated MIDI-synth room, has opened at the Los



Discovery Systems digital audio studio, Dublin, OH.





Larrabee Sound, Los Angeles.

Angeles **Record Plant** complex. The independent operation was launched by **Steve Deutsch**, a Los Angeles-based session player and synthesist.

The room houses a TAC Scorpion 32x8 console, JBL 4425 and Yamaha NS-10M monitors. An Apple Macintosh Plus, running sequences software, links MIDI-capable keyboards, sequencers and outboard gear. A library of digitally sampled sounds is available, as well as the capability to create new sounds. Recorders include a Fostex B-16 16-track, Technics 2-track and Sony PCM-501-ES digital processor with time code video lockup for scoring. "I developed the basic equipment package at my home studio while working on TV and film scores," Deutsch explains. "Chris Stone, president of the Record Plant, convinced me that there was a real need for a compact synthesizer studio designed for songwriters, scoring composers and jingle producers. I added some gear to make it a fullservice professional facility." 10.32 N. Sycamore Ave., Hollywood, CA 90038; 213-653-0240.

EFX Systems (Burbank, CA), has purchased two Sony MXP-3036 production consoles and the Sony ADS-3000 time code-based hard disk automation systems. The post-production studio has also added two Sony PCM-3324 DASHformat 24-tracks and two PCM 3302 2-tracks. 919 N. Victory Blvd., Burbank, CA 91502; 818-843-4762.

Larrabee Sound (Los Angeles) has recently remodeled its pair of production studios. Both are equipped with Solid State Logic 56-input SL4000E consoles



with Total Recall and dual **Studer A-800** multitracks. Outboard racks include **Lexicon 480L, 224XL, 200, PCM-70** and -42 digital effects units. Also featured are **Yamaha REV-1** and **SPX-90** effects units and **Focusrite** equalizers. *8811 Santa Monica Blvd., Los Angeles, CA 90069; 213-657-6750.*

At **Sunset Sound** (Hollywood), **George Binder** has joined the staff as chief technical maintenance engineer. He is a graduate of the University of Miami, and has been with the studio since April 1985 as a maintenance engineer. At **Sunset Sound Factory**, Hollywood, **Jeffrey Bork** has been promoted to the position of chief technical maintenance engineer. Bork was formerly a maintenance engineer at **Sunset Sound** and, prior to that, with **Baby-O Recording Studio**, Hollywood, *CA* 90028; 213-469-1186.

FilmCore (Hollywood) has expanded its sound effects library and added a Sequential Prophet 2000 synthesizer. The 2000's digital sampler capability can produce 16 different sounds on the keyboard simultaneously, manipulate any of the 10,000 existing sounds or create new ones. 6725 Sunset Blvd., *402 Los Angeles, CA 90028; 213-462-5765

Music Grinder (Los Angeles) has upgraded its facilities to 46-track capability with a Studer A-800 MkIII, a GML equalizer, an AMS RMX-16 digital reverb, a Yamaha SPX-90 and REV-7 digital processor.

A new machine room has been added to house a **Studer** and **MCI JH-24** multitracks. 7460 Melrose Ave., Los Angeles, CA 90046; 213-655-2996.

Northern California

Live Oak Studios (Berkeley, CA) has opened The Attic, described as a fully equipped, preproduction and electronic music facility. Linked via 16 tie lines to a 24-track studio located on a lower floor, the new facility is designed for cost-effective demo and record production, as well as sequencing and programming of electronic music projects.

Hardware includes a Kurzweil 250 digital synthesizer with 50kHz sampling option, a Yamaha TX-816 rack system with eight DX-7 modules, Opcode Systems Voice Editor and Librarian software (5,000 patches). An Apple Macintosh runs Mark of the Unicorn Performer software for up to 250 tracks of MIDI control/recording, sequencing and music notation.

Other synthesizers are by E-mu, Oberheim, Garfield and Casio. Outboard processes include a Publison Infernal Machine 90 dual stereo reverb/delay line, pitch shifter and 42-second sampler. 1442 A Walnut St., Suite 364, Berkeley, CA 94709; 415-540-0177.

Northwest

Cascade Recording (Portland, OR) has added an Otari MTR-12 2-track, Otari MX-5050 II, two Audio Digital TC2 processors, an Aphex Exciter, Eventide Harmonizer and a Nakamichi real-time cassette duplication system. Monitors include UREI 811 and Yamaha NS-10M. Staff additions include an engineer, Rick McMillen and Jenny Trukositz, who will manage promotions and general office administration. 2115 N. Vancouver Ave., Portland, OR 97227; 503-287-1662.

Canada

Smooth Rock Studios (Calgary, Alberta, Canada) has installed an Audio Kinetics Q-Lock 4.10 synchronization system with Eclipse Editor and Q-Link, a Mitsubishi PD-Format X-86 2-track and an Otari MTR-12 series II analog 2-track with center time code and CB-109 remote. *1-D, 624 Beaver Dam Rd., N.E., Calgary, Alta, Canada T2K4W6; 403-275-6110.

Westward Communications Ltd./Spot Shop Studio (Vancouver, BC) has recently installed a Meyer 833/834 monitoring system. The system is said to feature a linear frequency response and offers a maximum output capacity at 120dB SPL. 363 Adelaide St. East, Toronto, Ontario, Canada M5A 1N3; 416-868-0528.

Send Studio Update announcements to: Sarah Stephenson, Recording Engineer/Producer, Intertec Publishing, 9221 Quivira Road, Overland Park, KS 66215.



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> Dealers Inquiries Welcome Stewart Electronics P.O. Box 60317, Sacramento, CA 95860 (916) 635-3011

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UREI C series studio monitors

Designed with higher input sensitivity than the previous series of Time Aligns, the new 811C monitor has a quoted sensitivity of 99dB SPL; figures for the 813C and 815C are 101dB and 103dB, respectively.

The unit's function is said to offer an improved frequency response envelope to beyond 17.5kHz. Each of the studio monitors use a new 801C coaxial midrange loudspeaker, which is combined with a titanium-diaphragm compression drive to provide a single-point sound source.

Additional bass drivers are used in the 813C and 815C for extended low-frequency response.

Circle (134) on Rapid Facts Card





Soundtracs FME series production console

The modular mixer is available in two mainframe sizes for either 22 or 32 modules. Module types include: mono input; mono input with remote switching; stereo input with remote start; and monitor input with eight monitor sends and group output with upper and lower monitor sections.

Metering is via 12 LED bargraphs that include a solo warning display and PSU rail indicators.

The majority of inputs/outputs are electronically balanced and the tape sends/returns are internally selectable to +4dBm or -10dBV operating levels.

Circle (129) on Rapid Facts Card

Pristine Systems CD controller software

The Sound Effects Manager software interfaces an IBM PC XT/AT or compatible with a Sony 60-disc CD changer.

Features include sound effects triggering and retrieval from libraries and other sources listed in the database. The software can also create and execute edit decision lists.

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Sanken CMS-7 stereo condenser mic

Designed for portable indoor/outdoor television and radio broadcasting and motion-picture production, the stereo mic can be used for in-field applications on a camera boom. The design enables one person to handle all outdoor stereo recording.

Circle (127) on Rapid Facts Card

Audio Control Industrial SA3050 spectrum analyzer

The 30-band display unit uses a largeformat, 270-dot matrix panel with variable resolution of between 1dB and 4dB per step, SPL on-off, and fast, medium and slow decay integration. The fullscale display range is a quoted 44dBa to 136dBa, or -56dBm to +36dBm.

Standard features include six

memories with read, write, freeze and RTA-memory comparison functions; three signal inputs; a phantom-powered balanced XLR mic input; FET instrumentation BNC input; and a balanced, bridging line-level input.

The unit includes a digital pink noise generator with adjustable output that can be used to drive a speaker directly.

Circle (132) on Rapid Facts Card



The MIDI-capable digital reverb system offers 100 user presets with frontpanel program descriptions and controls.

Functions of the rack-mount unit's 100 presets comprise 50 reverb, 10 gated, 10 reverse, 10 chorus, 10 delay and 10 echo effects.

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Soundcraft Series 8000 production console

The new unit features redesigned input/output and stereo master modules resulting in lower distortion and improved noise figures, the company claims.

The module offers 4-band parametric

EQ with switchable bandwidth, eight individual auxiliary sends and individual 8-bus routing with separate LED indicators.

The Series 8000 is available in both front-of-house and stage-monitor configurations.

Circle (133) on Rapid Facts Card



Harrison VGA-10 graphics display system

The unit is an interactive video graphic display and control system, and can be added to the Series 10 assignable console. It generates a 1,024x768 pixel, high resolution display, with up to 256 colors.

The display presents composite equalization curves, dynamics processor transfer curves, multimode displays of panorama and all of the Series 10's signal processing functions.

Information is displayed on a 19-inch video monitor and, by use of a mouse or other device, any or all of the parameters of the module may be modified. The VGA-10 hardware consists of a Harrison proprietary PC computer and video graphics display system with software and a communications controller card.

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Circle (43) on Rapid Facts Card 92 Recording Engineer/Producer April 1987

MicroAudio equalizer series

• Model 28 is a hand-held programmer for use with the programmable PODs 1.1 and 1.2. The unit adjusts each of the 28, ISO-centered third-ocatve EQ bands on either of the 1.1 or 1.2 EQ PODs. It measures 8"x6"x11/2".

 Model 1.2 equalizer POD is a blankpanelled, tamper-proof third-octave EO unit. It stores up to eight EQ curves, and is suitable for hands-off operation of EQ functions. The unit can be programmed to hold up to eight EQ settings, and has a quoted noise floor in excess of -93dBm. • Model 1.1 equalizer POD is a blankpanelled tamper-proof third-octave unit that stores one EQ curve in memory.

Circle (131) on Rapid Facts Card

DigiTech RDS 7.6 digital delay/sampler

The new unit can digitally record up to 7.6 seconds of sound samples.

The delay section features modulation controls for chorusing, flanging, phasing, doubling, echoes and infinite repeat. Input level selection switch and feedback controls are provided.

The delay has a quoted signal-to-noise ratio in excess of 85dB, with delay ranges of 1.5ms to 15ms.

Circle (136) on Rapid Facts Card



Studio Technologies Mic-PreEminence pre-amp and interface

Designed to interface between analog microphones and digital recorders, the unit operates as a transformerless balanced pre-amp.

Potential applications include minimizing signal flow through a console and digital sampling. In addition to phantom power, a signal indicator and trim control are also featured.

Circle (130) on Rapid Facts Card



Circle (45) on Rapid Facts Card

Circle (46) on Rapid Facts Card

Ensoniq ESQ-M synthesizer module

The ESQ-M is an 8-voice polyphonic, polytimbral synth module with three oscillators per voice. A choice of 32 multisampled and synthetic waveforms are available including piano, vocals and brass instruments.

A 16-character flourescent display shows 40 on-board programs with an additional 80 cartridge programs available. Circle (143) on Rapid Facts Card



Soundolier MVXA-195 monitor panel

The 7-channel amplified monitor panel is designed for mounting in standard 19-inch upright racks or console turrets. The units require 5¹/₄-inch of vertical panel space and provides both aural and visual monitoring.

The monitor panel incorporates a VU meter with three switchable sensitivity ranges of a quoted -10dB, 0dB and +10dB, a 2Wrms amp and a high compliance 4-inch speaker with integral input attenuator.

Internal input switches provide selection of 70.7V or 25V line-level signals on adjacent channels.

The unit is intended for low-voltage operation and requires a 24Vdc at 400mA maximum power source.

Circle (138) on Rapid Facts Card

coming in May: **Studio Design Electrical and Interface Systems** Details the electrical power, system inand Construction terconnect and grounding schemes for audio facilities. **Plus our regular departments Acoustic Design and Monitoring** Requirements **Other Features** Managing MIDI Discusses the types of acoustic design im-Sound on the Road plementation available to recording and Film Sound Today production studio operators, and the im-**Property and Employee Insurance** Living with Technology . What types of property damage, theft portance of considering the "room/mon- SPARS On-Line itor" interface. and personal liability insurance should a News and People studio operator purchase? Letter to the Editor Studio Update **Production Viewpoint: Customized Acoustics and Monitoring** New Products for Multifunction Facilities Narada Michael Walden Considers the different functionality and This innovative producer shares his proacoustic requirements for various types duction techniques for recent Whitney of audio recording and production ses-Houston, Aretha Franklin, George Bensions. son and Sheena Easton sessions.

Aries 10x4x8 mixing console

The 10-input, rackmount or desk-top console is said to be suited for studio and sound reinforcement applications.

Features include selectable mic and line input, 48V phantom power, 30-band EQ with switchable high and low frequency and sweepable midrange control. A post EQ, prefade insert point, mute, PFL switches and overload indicators also are available.

Four auxiliary sends per channel are switchable prepost in pairs, and eight monitor/FX returns are provided with equalization.

Circle (142) on Rapid Facts Card

Winstead V8701 equipment rack

Constructed to accommodate more than 1,000 pounds of electronic equipment, the rack provides 30 inches of space.

Tapped front rails allow simple installation of equipment, with back rails that adjust independently for equipment of varying depths.

The rack measures 78³/₄ inches and features removable side panels for installation and servicing of equipment. The bottom is open for air flow and cable access while the top is vented for cooling.

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digital peakmeter

ing model, the meter offers spot or bar

graph level indicators.

Available in a table top or flush mount-

Display range for Scale A is a quoted

-50dB to 0 and 0 to +10dB headroom.

Scale B is - 60dB to 0dB. Sampling fre-

quency is a quoted 44.1kHz, 44.056kHz.

operated with a hold function. Reset is

either manual, automatic or via the

remote connector. The modulation long-

term maximum level is stored in the

peak memory and can be displayed by

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pushing a button on the instrument.

Error flag and overload indicators are

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Industry West Electronics Hypersound 115

Measuring 4% "x8¹/4" x14¹/4" and weighing 13 pounds, the portable sound system from IWE is said to be capable of providing an SPL of 115dB at 1m.

Such performance is said to result from the use of charge pump amplifiers, triband peak processors and back wave phase inverters.

The system uses triplex amplifiers and a non-interruptable 3-way auto power select. It has a battery life of up to 20 days continuous use.

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JL Cooper Electronics MSB Plus MIDI matrix switcher

The programmable 8x8 matrix switcher stores 64 setups and features MIDI Transpose, Channelizing, Data Filtering, in addition to programmable merging.

MSB Plus uses two sets of programmable MIDI processors, each of which can be assigned to any input jack. The output of the processors can be assigned to individual MIDI output jacks, or can be merged into a single output. The transpose function will transpose incoming MIDI notes over ± 5 -octave range, while the channel jump feature will increment the incoming MIDI channel number to any other channel number.

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DOD Electronics R-231 Series C graphic

The rackmount unit offers two channels of 31-band, ISO-centered thirdoctave equalization in a 2U (3½-inch) package. Available cut or boost is a quoted 12dB.

A status LED indicates whether the equalizer and the low cut filter is in circuit. The unit's slider controls feature center detents with 40mm of movement. A master level control offers up to ± 12 dB of gain. A 4-segment LED bargraph indicates input signal levels.

Circle (128) on Rapid Facts Card

Soundcraft module options

for series 500 and 600 consoles

models featuring 4-band EQ, routing to

all eight buses and the stereo bus, and ac-

cess to six auxiliary sends.

Stereo inputs are available for both

The fully balanced stereo input can be

used as an effects return for signal pro-

cessing on additional tape or Compact Disc returns.

Available for the series 500 is a 4-input module option kit that retrofits to the right of the output section. The user can select between mono or stereo inputs, which can be used for effects returns, or any combination of the two.

For the series 600, a monitor module expands the monitoring capabilities with eight additional line returns for full 24-track monitoring.

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Mitsubishi X-400 PD-format 8/16-track

The 8-channel recorder records a total of 14 tracks on ½-inch tape. In addition to the eight digital channels, two digital tracks are provided for error correction coding and two for analog cue tracks. One digital auxiliary and one time code track are also included.

The unit is compatible with the

16-channel X-400 ¹/₂-inch transport, allowing tapes recorded on the X-400/8 to be played back on the X-400/16.

A 14-inch reel capability provides one hour of recording at 30 ips.

Circle (135) on Rapid Facts Card

Accessories for Shure SM 98 mic

The new A98MK unit allows mounting of the SM98 mic to any drum rim. It features a flexible gooseneck section, adjustable height and angle and matte black finish.

For reducing sibilance noises, the A98PF pop filter kit features locking collar to protect the mic against theft.

For permanent installations, the A98-G18 18-inch gooseneck allows mounting on a variety of surfaces, while the A98HA hanging adapter, positions the SM98 at a 45° downward angle.

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NEW Studer A820: Back to the Future

The future of multi-track mastering was commonly assumed to be 100% digital. But now Studer has built a multi-track for the future...by going back to thoroughly refine and update analog technology.

For the best possible combination of reliability, production capabilities, format compatibility, and sonic performance, the Studer A820 challenges *all* competitors. Analog *and* digital. No matter the price.

First, the A820 is fast and flexible. With total microprocessor control, it starts smoother, locks quicker, locates faster, and shuttles tape better than anything the competition has yet to offer. The tougher the job and the tighter the deadline, the more you'll love the A820.

The A820 is also fully user programmable. An extensive software menu lets you choose the operating features you

want, and audio alignment is automatic with all parameters (including NR levels) set and stored digitally.

Finally, the A820 shakes the "sound assumptions." With new amorphous metal heads, advanced phase compensation circuits, and fully integrated Dolby™ SR as an option, the A820 boldly challenges the costliest digital machines for overall sonic performance. Let your ears be the judge.

Some other manufacturers apparently assumed analog could not get significantly better. With the arrival of the A820, that's now a questionable assumption. Call your nearest Studer office for detailed directions back to the future. Studer Revox America, Inc., 1425 Elm Hill Pike, Nashville. TN 37210, (615) 254-5651

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