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Studio Cameras p.44

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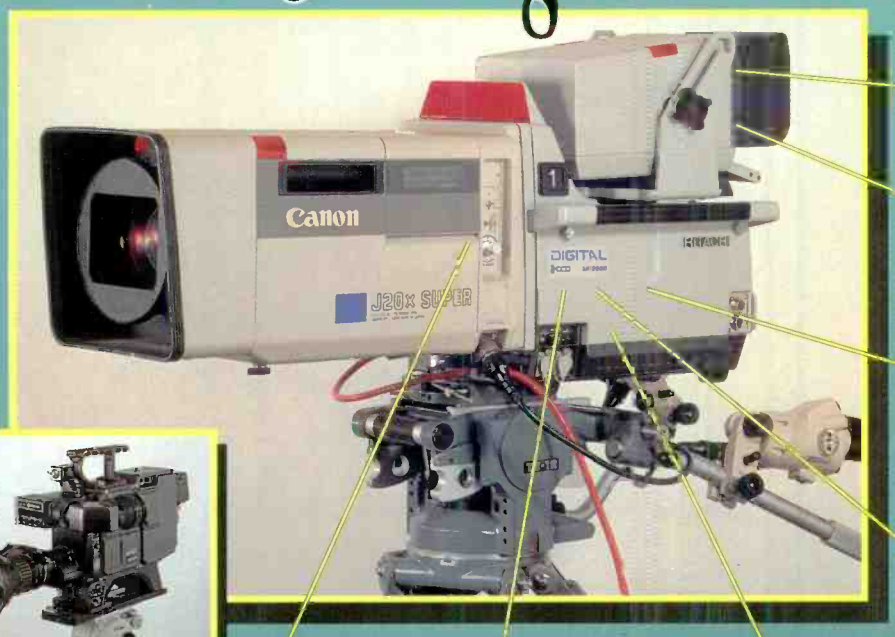

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If you can shoot it, route it and store it, you've accomplished most of what you need for video production. This month's feature coverage looks at ways to do all of these tasks and more in new, innovative and cost-effective ways.

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ON THE COVER:

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News

By Dawn Hightower,
senior associate editor

Broadcasters oppose spectrum royalty fee proposal

The National Association of Broadcasters (NAB) opposes the creation of spectrum royalty fees to help pay for implementation of the GATT treaty.

Broadcasters would be charged a 1% gross receipts tax the first year, with the amount increasing 1% every year for five years. The proposal is designed to raise $4.8 billion during the first five years of its implementation.

NAB opposes the tax for the following reasons:

- A spectrum royalty gross receipts tax will have a devastating impact on thousands of broadcasters. Many radio and TV stations lost money last year. A tax on gross receipts will put many of those stations out of business.
- Broadcasters already pay millions of dollars in business taxes, FCC fees and cost-of-regulation fees. They also pay for using the spectrum through providing the public free-of-charge with news, weather, public service, local and other public interest programming.
- Broadcasting is dependent on ad revenues, so the cost of spectrum royalties cannot be passed on to consumers.
- The creation of new fees goes against the foundation of broadcasting. Broadcasters receive licenses to serve the public interest in exchange for providing free, over-the-air service. By charging broadcasters for their spectrum licenses, the government is reneging on that contract.
- Congress rejected the notion of auctioning mass media or broadcast spectrum last year, when it passed legislation creating spectrum auctions for other types of spectrum. The new royalty proposal goes against the Congressional recognition that broadcasters' role is unique among spectrum users.
- To use spectrum royalty fees to help offset the costs of implementing a trade treaty is absurd. Broadcasting is not involved in these trade issues, and entertainment issues were not included in the GATT agreement.

Standards group reviews infopike proposals on data broadcasting

The following industry groups have submitted data broadcasting proposals as they vie for the industry standard for delivery of high-speed data services that would be built-in to conventional TV broadcast signals: BlueMont Telecom, Montreal, Quebec; Centris Communication/Leitch Video, Columbia, MD; Digideck Inc., Menlo Park, CA; Radio Telecom and Technology Inc., Riverside, CA; and WavePhore Inc., Tempe, AZ. Each company hopes to have its system chosen by the National Data Broadcasting Committee (NDBC), a voluntary standards-setting group sponsored by the NAB and the Electronic Industries Association (EIA).

The selection of a data broadcasting standard is important because it will allow broadcasters to participate in the information superhighway and offer consumers digital services built-in to today's analog TV broadcast signal. At data rates of hundreds of kilobits per second, a variety of digital video, audio and computer services can be offered to consumers and may also provide a second revenue stream for broadcasters.

The NDBC will evaluate all the proposals, select one or more practical systems, initiate evaluation tests and recommend voluntary standards. Testing is expected to begin in the last quarter of this year.

For more information, contact Lynn Claudy at NAB at 202-429-5346 (fax 202-775-4981) or Brian Markwalter at EIA at 202-457-7733 (fax 202-457-4985).

EIA announces EDS standard

The Electronics Industry Association (EIA) has announced the official release of its extended data service (EDS) standard "Recommended practice for line 21 data service," EIA-608 document. The document was developed by the EIA's Television Data Systems Subcommittee (TDSS), and describes a method for full use of the VBI line 21 field 2 for additional captioning and other extended data services. The first draft of the EIA-608 document was released in April of 1993. An initial prototype was shown at NAB '93. Since that time the document has undergone final revisions and has been approved as an EDS standard by EIA members, the American National Standards Institute (ANSI) and the TDSS committee. Products incorporating EDS technology were shown for the first time at NAB '94. EDS can provide program name and description, length in hours and minutes, rating, category type and amount of time until a program concludes, and other information such as time of day and emergency weather reports. ■

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BROADCAST ENGINEERING (ISSN 0007-1994) is published monthly, except semi-monthly in November, and mailed free to qualified persons within the United States and Canada in occupations described above. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address changes to Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66282-2901.

SUBSCRIPTIONS: Non-qualified persons may subscribe at the following rates: United States and Canada: one year, $50.00. Qualified and non-qualified persons in all other countries: one year, $60.00 (surface mail); $115.00 (air mail). Single copy sales, $5.00. Subscription information: P.O. Box 12937, Overland Park, KS 66282-2937.

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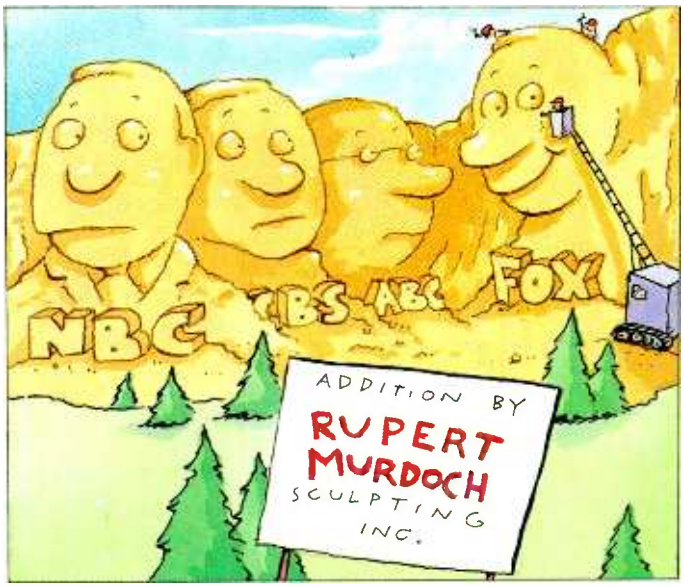
Editorial

The changing face of American broadcasting



The stone foundation of broadcast television was shaken on May 24 with the announcement by Fox Broadcasting of the addition of 12 new affiliates. Although Fox looked the part of a winner, CBS, ABC and NBC scrambled to put a best light on the situation where they all lost stations.

When Fox out bid CBS last fall for NFL's National Football Conference broadcast rights, some saw it as a big mistake. After all, how could the network make any money with the games being broadcast in some markets by second-tier stations. Well, those pundits apparently didn't know Rupert Murdoch very well. The NFL contract was clearly but one step in his bold plan to become not just another "me-too" network, but a full-time player in every sense of the word.

Here at my home base, the talk around the drinking fountain wasn't so much what our former NBC affiliate will be broadcasting as a Fox affiliate, but who's going to get the NBC network. The viewers don't really care whether the Simpsons is on Channel 4 or 41. What they do care about is their favorite soap opera and local baseball team.

The larger issue isn't what afternoon soaps will be on what stations, but how this realignment may affect the entire national network structure. In one sense, it weakens all the networks. The pie isn't any bigger, it just will be divided among four semi-equal players instead of three semi-equal players. And if Paramount and Time Warner have their way and launch their networks, look for more affiliate shakeups.

This mega deal may remind you of the TCI-Bell Atlantic story. While the transaction was never completed, the mere audacity of such an arrangement shook the media world. Although the deal eventually fell from its own weight, it clearly set the tone for future ventures.

The key point for terrestrial broadcasters is that the Fox announcement is but another example of the changing nature of this business. While station managers and engineers shouldn't quake in their boots about the recent changes, they should recognize that sitting back and assuming the view (or channel) won't change is more than short-sighted. It's suicidal.

Brad Dick

Brad Dick, editor

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FCC Update

Better safe than sorry

Harry C. Martin and Andrew S. Kersting

Broadcasters should periodically conduct a self-inspection of all facilities, including their transmission site and tower, to ensure compliance with applicable FCC rules and regulations. The first step in reviewing a station's technical operation is to check the areas where FCC inspectors most often issue violations. See the inspection checklist for the pertinent sections of the FCC rules.

Broadcasters need to periodically conduct a self-inspection of their facilities. This is not only good business practice, it's the law. The point of such an examination is to ensure that the station is in compliance with all FCC regulations.

The first step in such a process is to review your station's technical operation and the place to begin is where FCC inspectors are issuing violation notices. The example checklist will help you to identify those technical areas often targeted by the FCC for a close look.

Work through this list. Look closely at these areas for the stations for which you are responsible. For some engineers (chief operators) this process will need to be completed for each station. (*Editors note:* The NAB publications department has a guidebook called the *NAB Guide for Broadcast Station Chief Operators*, which provides a checklist that engineers and managers can use for technical and non-technical areas. The cost is $30 for members and $60 for non-members. It may be ordered by calling 1-800-368-5644.)

Although it may take some time to work through the list, it represents time well spent. The last thing any engineer or manager wants is a notice of violation or even a fine for not complying with FCC rules. The adage "Better safe than sorry," certainly applies here.

Sample FCC inspection checklist

- ✔ All towers are correctly painted — (17.50)
- ✔ AM towers are properly fenced — (73.49)
- ✔ All current station authorizations (including auxiliary) are posted — (73.1230(a))
- ✔ Chief operator is designated in writing and posted — (73.1230(a) & (b))
- ✔ Contract chief operator agreements are on file — (73.1870(b)(3))
- ✔ Chief operator's and all duty operators' licenses posted — (73.1230(a) &(b))
- ✔ AM monitor point descriptions are correct — (73.158)
- ✔ Chief operator is making weekly station log review — (73.1870(c)(3))
- ✔ Station logs for the past two years are available and complete — (73.1840)
- ✔ All station logs indicate a weekly EBS test sent and received — (73.961)
- ✔ Remote control and metering operational and calibrated (73.1410)
- ✔ Most recent equipment performance measurements available and complete — (73.1590)
- ✔ Transmitted signal meets FCC specifications and is in accordance with station license — (73.44/73.317)
  - (i) Operating power within limits (90%-105%) — (73.1560)
  - (ii) Modulation within limits 100% — (73.1570)
- ✔ Operators are properly trained — (73.1860)
- ✔ EBS receiver working and tuned to proper station — (73.932)
- ✔ EBS test transmissions OK.
  - (i) Both tones present — (73.906)
  - (ii) Each tone modulates transmitter at 40% — (73.906(c))
  - (iii) Tone duration 20-25 seconds — (73.906(d))
- ✔ EBS encoder is FCC-type accepted (i.e. no tones on cart) — (73.942(a))
- ✔ EBS checklist with authenticator envelope at operator duty position — (73.908)

FCC initiates inquiry into broadcast and cable EEO regulations

The FCC has initiated an inquiry regarding the effectiveness of its EEO rules governing the broadcast and cable industries. The commission is requesting information to assist it in preparing its October 1994 report to Congress on the effectiveness of its EEO policies as required by the 1992 Cable Act.

The FCC noted that some broadcasters believe they have unique difficulties attracting and retaining minority employees because they are located in small markets.

In addition, the commission proposed changes in its standard inquiry letters, which currently request recruitment and hiring information for the last three years of the license term. The FCC requested comment concerning whether its inquiry letters should be revised to request information for the entire license term, or for some lesser period of time.

The commission also requested comments concerning whether part-time employees no longer should be considered in an EEO review, or, alternatively, how much consideration should be given to part-time hires in light of the FCC's emphasis on full-time positions.

In another initiative, the FCC asked whether it should supplement its renewal inquiry procedures by conducting on-site audits of broadcasters in certain cases. ■

Martin and Kersting are attorneys with Reddy, Begley & Martin, Washington, DC.

Date line

Annual ownership reports or ownership certifications for commercial broadcast stations in the following states must have filed by Aug. 1, 1994: North Carolina, South Carolina, Illinois, Wisconsin and California. In addition, TV stations in California, and LPTVs and TV translators in Kansas and Nebraska must file their renewal applications by Aug. 1, 1994.

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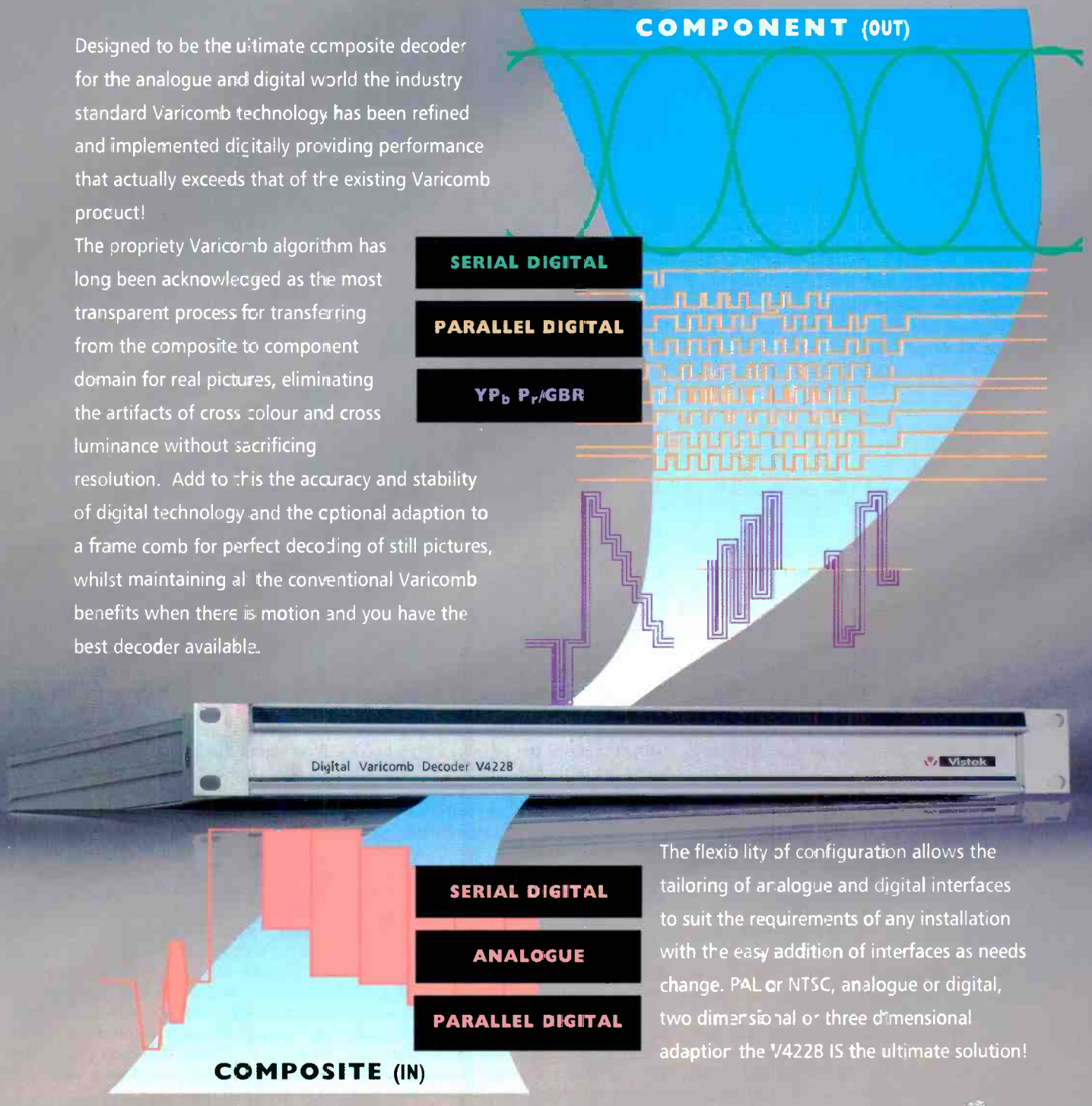

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Strictly TV

Audio for HDTV

By Curtis Chan

On the HDTV news scene, a letter from the NCTA, addressed to FCC chairman Richard Wiley, asked for limitations on the uses of the full HDTV bandwidth. MSTV's president, Margita White, said that she regrets the letter's objection to ancillary services because it introduced "discord and confrontation near the end of a historical cooperative process." The letter further pointed out broadcasters have been able to use the vertical interval of NTSC for non-broadcast commercial purposes for years, and turning over part of the HDTV channel to such uses would simply be an extension of that. White concluded the cable industry would be the major beneficiary of the quick introduction of HDTV because it didn't have to wait for the ratification of the standard to begin its own service.

The HDTV audio standard

This month's focus turns to the acceptance of Dolby's AC-3 digital coding system, which was selected by the Grand Alliance to deliver multichannel digital surround sound for HDTV. Furthermore, AC-3 has been approved by the FCC's Technical Subgroup for the Advisory Committee on Advanced Television Service for incorporation and testing later this year. AC-3's 2-channel form is already being offered by General Instrument, as an integral part of its DigiCipher II all-digital satellite and cable TV systems.

AC-3

Dolby AC-3 is a perceptual digital audio coding technique designed to take maximum advantage of human auditory masking. AC-3 allows for the storage or transmission of up to six audio channels in less bandwidth than is required for only one channel on a CD. The current SMPTE-recommended 5.1 channel system running at rates as low as 320kb/s, comprises five full bandwidth channels representing left, center, right, left-surround, right-surround and a low-frequency subwoofer channel.

AC-3 is fundamentally an adaptive transform-based coder using a frequency-linear, critically sampled filter bank technique. The advantage of the filter bank-based coding is signal components and corresponding quantization noise components are each kept within *critical bands*. This derives maximum benefit from the masking characteristics of the human ear, and minimizes the resulting data rate needed for perceptually noise-free coding. In the presence of wideband transients, the transform block length of the filter bank can be dynamically reduced to contain quantization noise within a small temporal region about the transient. That is, AC-3 divides the audio spectrum of each channel into narrow frequency bands of different sizes optimized with respect to the frequency selectivity of human hearing. This makes it possible to sharply filter coding noise so that its frequency is forced to stay close to the frequency components of the audio signal being coded. By reducing or eliminating coding noise wherever there are no audio signals to mask it, the sound quality of the original signal can be subjectively preserved. In this way, bits are distributed among the filter bands as needed by the particular frequency spectrum or dynamic nature of the program material. A built-in model of auditory masking allows the coder to alter its frequency selectivity to make sure a sufficient number of bits are used to describe the audio signal in each band, thus ensuring that the noise is fully masked.

To capitalize on the multiplicity of channels, a dynamic bit allocation technique assigns bits across frequencies and channels as needed from a common bit pool, while taking into account both intra- and interchannel masking effects. This common bit pool technique allows channels with greater frequency content to demand more data than channels with less frequency content. It can also be used as a selective and powerful noise reducer where strong sounds in one channel can be used to mask noise in other channels.

Finally, coding gain is derived from separating and independently coding high-frequency carrier and envelope information. As a result, AC-3 can process at least 20-bit dynamic range digital audio signals over a wide frequency range. Sampling rates of 32, 44.1 and 48kHz are supported with subsequent data rates from as low as 32kb/s for a single mono channel to a high of 640kb/s.

Forethought

AC-3's absence of matrix-based (adding and subtracting of signals) processing has no impact on already-matrixed program material, such as Dolby Surround Lt/Rt signals applied to two of the five full-bandwidth AC-3 channels. In addition, the bitstream syntax and decoder operation have been designed to allow future encoder algorithm improvements to be compatible with current decoder hardware. The data format and overall system operation have been designed to allow editing at a block level without the signal having to be re-encoded. The data input to the decoder can be rocked back and forth, and when fed in reverse block order, the decoder will properly reproduce the audio time-reversed. Last, it's anticipated that an AC-3 encoder might be able to derive an amplitude compression signal that would allow the listener to select compressed, partially-compressed or undercompressed sound presentation.

AC-3 on a chip

One of the primary design objectives of AC-3 was to facilitate implementation on, and portability across, multiple DSP platforms. Initially, the encoder used six 27MHz Motorola 56001 chips; the decoder needed 11. Early units employed a pipeline architecture that imposed significant data-passing overhead. Recently, the encoder and decoder have been realized on silicon. Versions of both have each been implemented on a single Zoran ZR-38000 chip.

By coding a multiplicity of channels as a single entity, Dolby's AC-3 is able to achieve greater coding efficiency than is possible with equivalent single-channel coding techniques.

■

Chan is president of Chan and Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA.

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Management

Engineering image is important

By Rick Morris

Sam had been a chief engineer for the last five years. The general manager who hired him had taken another job, and the national sales manager was promoted to general manager. The new GM didn't understand what engineering was all about. He turned down most of the capital requests for the year, saying that the station was running fine. Sam's salary review also was lower than last year's. It was clear that the GM didn't understand what Sam did or how well he did it. Sam listened to others at the station who said that upper management never understood or cared about the engineering department and couldn't understand the complexities of the engineering part of the business. He decided it was up to him to change that attitude.

The best engineers can be their own worst enemy

Well-run engineering departments are marked by the fewest problems. A good engineering department maintains near 100% transmitter system reliability, keeps problems down by performing routine maintenance, responds quickly to repair requests and handles remotes without a hitch. Compare this performance level with other departments in a station. Programmers are successful if one in five of their program picks are a success; salespersons achieve top status by making only one in 10 sales. But an engineer who maintains only 90% transmitter reliability could be fired for excessive off-the-air time.

Often, general managers who supervise chief engineers understand little about what they do. It's up to you to make others aware of the good job you're doing.

Educating others

The lack of understanding of what the engineering department does goes beyond the GM to interaction with all departments. If someone doesn't understand what it takes to provide the requested services, they won't support your requests for resources to meet those needs.

Morris is an assistant professor of radio/TV/film at Northwestern University. He is a former chief engineer and a former manager of engineering and maintenance for a major TV network.

Benefits of an "engineering literate" station are enormous. It takes time and training to become a good broadcast engineer. However, there is nothing so complex about broadcast engineering that you cannot impart an understanding of the issues and abilities to your non-technical colleagues.

Your goal in this process is to impart an understanding of: 1) the capabilities of the existing facilities of the station, 2) the limitations of the existing facilities of the station, 3) additional capabilities that new resources could provide and, 4) the challenges and performance of your department in meeting the needs of other departments. If other departments have an understanding of these concepts, they will know what you're working with, your challenges and successes, will appreciate when you perform well for them, and can advocate for new equipment.

Educate the station painlessly

Watch the content of your communications outside of the department. For example, suppose you are chief at a UHF TV station and your final visual klystron is showing its age and has tripped off a couple of times so you're sure that a replacement will be required soon. If you're a good engineer, you will order the replacement tube and when the old one fails, slip into multiplex operation and replace the klystron on the first overnight available. The engineering department would look good; however, no one would know about the high level of skill and forethought you had brought to the situation.

Instead of just replacing the klystron, and going on with business as usual, you should speak up at the GM's weekly staff meeting, and discuss how you identified that a klystron was failing, and explain that it is the main power tube for the station. Without it the station would put most of its coverage area at risk. However, because engineering is prepared for these situations, a new klystron has been shipped and will be standing by for replacement and off-air time will be minimized.

This defines the engineering concept and places the action in terms that are relevant and important to other departments (minimizing off-air time/protecting revenue). It also educates other departments about the work engineers do. After the klystron has been replaced, issue a memorandum thanking your engineering staff for their swift and competent action. A memo is a good way to make public your department's success while also providing positive feedback to your employees.

...an engineer who maintains 90% transmitter reliability could be fired for excessive off-the-air time.

If your station has a newsletter, use it to educate others on the successes and challenges of engineering. Also, when someone asks you a question, take the time to make sure they understand the answer. This is a chance to spend a few extra minutes and give a mini-tutorial to someone that is interested in finding answers. The solution to not being appreciated is communication. You are already doing a good job, and you need to help others understand that.

Educating your boss (technically)

As you work with the general manager, take extra time to explain the technical basis for your decisions and why equipment, parts or people are important to achieve the station's goals. Be farsighted. Generate position papers on the future challenges facing the engineering department. It is better to have discussed the costs and benefits of Radio Data Services, or the new equipment that you need, before the GM has identified the business imperative. By making sure that the GM is engineering literate, you will help him to identify business opportunities, protect existing revenue, and prepare him to respond to questions from group headquarters. ■

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Selecting the right location

By David Leathers

When your production hits the road, plenty of factors need to be considered when selecting a suitable remote location. First, before starting a location search or site survey, you must fully understand what the director is looking for and what will occur on the shoot. Then you can examine prospective sites in an informed and careful manner.

Although the director or field producer will be concerned with the right look, it is only one of the many concerns that your thorough location evaluation should address. Start by checking out any limitations to access and availability at a location. If a site can only be used one day a week, the production manager must know this early on to avoid scheduling problems.

Next, consider the logistical needs for water, power, restrooms, telephones, food, meal areas, make-up and wardrobe space. Locate the closest emergency/medical facilities and services; this is especially important when stunts or special effects are involved. For longer-term projects, a secure area to store equipment or a place to set up a production office is often necessary. If there are minors involved, you'll need classroom space, as well.

What about the surrounding noise? If there is an airport nearby, this can ruin live sound and result in time delays (or costly post-production fixes) for recorded takes.

Other important considerations include the number of talent and crew, whether utility or portable generator power will be used, the number and types of vehicles involved, whether dressing rooms will be needed, and what other special equipment might be required. Determine any existing or potential traffic and accessibility problems, and ensure adequate parking will be available. Oversized vehicles may require special parking permits, especially if their specific location is critical during the shoot. This is particularly important in crowded urban environments where shoot permits obtained in advance will guarantee that temporary no-parking is enforced by local police to reserve the required locations for your vehicles.

Will overnight accommodations or a shuttle bus for talent and crew be required? If so, for how long and how many people? When other crews or the public will also be traveling to the area at the same time, reserve your accommodations well in advance. Also book a few extra rooms that you can cancel without charge at the last minute if they aren't needed.

Locations and the shooting schedule

Even after deciding on a location, try to have a viable back-up site in mind. Many factors can affect a production, so having a "Plan B" is important. Also consider the following preparation issues:

- *Special access and permits:* Certain locations may present problems or restrictions for stunts or special effects. They often may require additional preparation time and special permits, which could require access to the location many days before the actual shoot.

- *Period pieces:* For dramatic productions with scripts set in anything other than the present, location elements may have to be made to fit the desired period. For example, a 1950's street scene can't have 1990-vintage streetlights. Special sets may have to be constructed, requiring time to be allotted and scheduled.

- *Interiors/exteriors, day/night:* Know in advance whether indoor and/or outdoor sites will be used on location, and whether daytime and/or night-time scenes will be shot. This will affect scheduling and the amount of control you'll need on the surrounding areas. Shooting at night can simplify and complicate location shoots. Neighbors may object to having a crew working all night; on the other hand, in a downtown area, there may be no one around who cares. For scheduling purposes, determine the hours of daylight available and the times of local sunrise and sunset when evaluating any location.

- *Seasons and weather:* The time of year also will determine the suitability of many locations. Along with shorter daylight hours in winter months in the northern hemisphere, unusual weather conditions may also occur during other times of the year in certain areas. A location's propensity for fog, high winds, snow, ice, rain, tornadoes, hurricanes, excessive heat/humidity, bitter cold or other inclemency will be well known by local residents and meteorologists. Knowing about these problems ahead of time can help keep things on schedule.

Of course, volatile weather conditions are sometimes just what a producer needs. When one production company did a recent Budweiser spot, it wanted 10-foot waves on the north shore of Hawaii during a 4-week summer shooting window. The weather service they consulted advised them that those conditions would be highly unlikely and instead suggested Mexico, Tahiti or Fiji due to the storm patterns. The producer paid heed and sent a small second unit to Fiji, leaving the main crew in Hawaii filming beach scenes. This strategy paid off, getting them the shots they needed at minimum expense.

Help is available

Before you set out on a search for locations, take advantage of the resources that are available. Local and state film commissions can be helpful, especially for areas you are not familiar with. They can supply you with pictures, labor and housing costs, weather patterns and other valuable information, usually at no cost. If the budget allows, consider using a location service, which typically charges the production company for its work.

Many weather services also are available. Some are free and others charge a fee for providing more detailed, up-to-the-minute reports on specific areas.

A location scout must be able to think like a producer, a director, a cameraman, a production manager and virtually every other key crew member. The more information that scouts can gather *before* the location-search or site-survey process begins, the better equipped they will be to suggest the best locations. ■

Leathers is president of Eye Square, Culver City, CA.

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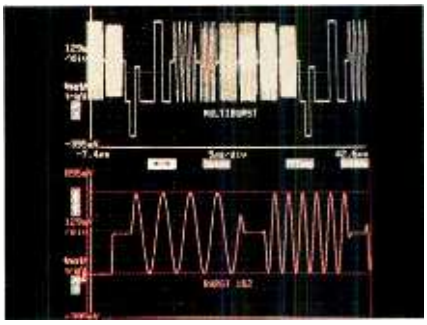
Part 3

Troubleshooting

LAN technology

Selecting the right network

By Kevin McNamara



In the PC-based network world, there are two choices — client-server or peer-to-peer. When most people think of networks, they envision expensive computing apparatus. This may be true in larger operations, however, many businesses are using plain old PCs with a minimal amount of additional "stuff." Depending on your specific needs, you must decide which type of network operating system to purchase. Key factors to consider are: 1) number of users, 2) types of applications, 3) ease of administration, 4) protection of data, 5) security issues, and 6) the ability to interface with other operating systems (i.e. UNIX, Mac, OS/2, etc.).

Another factor that is important, but may get overlooked is, "What does the network need to accomplish?" The answer may differ among system users. Have meetings with staff members who will be affected, initially or in the future. Use the meetings to establish present and long-term requirements, such as: Who needs which applications? Who needs to share devices (i.e. printers, modems)? How will critical data be preserved? Be detailed and take lots of notes. At the conclusion of the meetings there should be enough information to draw a matrix that associates specific users to specific tasks. This will form the basis for the next step — choosing an operating system.

McNamara is engineering manager for WGAY/WWRC radio, Washington, DC.

Client-server networks

Novell has dominated the "client-server" market. In client-server networks, one computer must be a "file-server" and the rest are "clients." A file server is in the business of serving files and, once properly configured, will hold the applications and data files common to the network. It also handles the network operating system and related utilities.

Novell presently offers three versions of network operating systems — version 3.11, 3.12 and 4.01. Version 3.12 is an upgraded version of 3.11 that fixes some bugs from the prior release and adds support for CD-ROM drives in the file server. Version 4.01 is a new operating system suited for large networks that contain multiple file servers in multiple locations (also called wide area networks or enterprise networks). However, its use is not limited to just large systems.

If you're concerned about losing data because of a disk drive failure, Novell supports disk mirroring (two identical drives, one controller) or disk duplexing (two drives, two controllers). A tape back-up system also is recommended.

The directory structure of a hard drive on a file server is different from that of the PC on your desk. The highest level in the directory structure of a network hard drive is called a "volume" and is similar to the letter designations assigned to disk drives in DOS. Unlike DOS, a volume can span up to 32 hard disks.

Security within the network will be the single most important administrative task. All users on the network will be given a log-on name and password by the network supervisor. It's also the supervisor's job to assign users appropriate "rights" to programs or data that reside on the network file server. Network security has four levels:

- *Password* — gives user access to the file server
- *User's rights* — information the user can access, create or modify
- *Attribute rights* — further limits the user's ability to change a file or directory (i.e. deleting, copying, viewing)
- *File server* — allows user to access/manipulate functions of the file server (i.e. shutdown or modification of the system, addition or deletion of users)

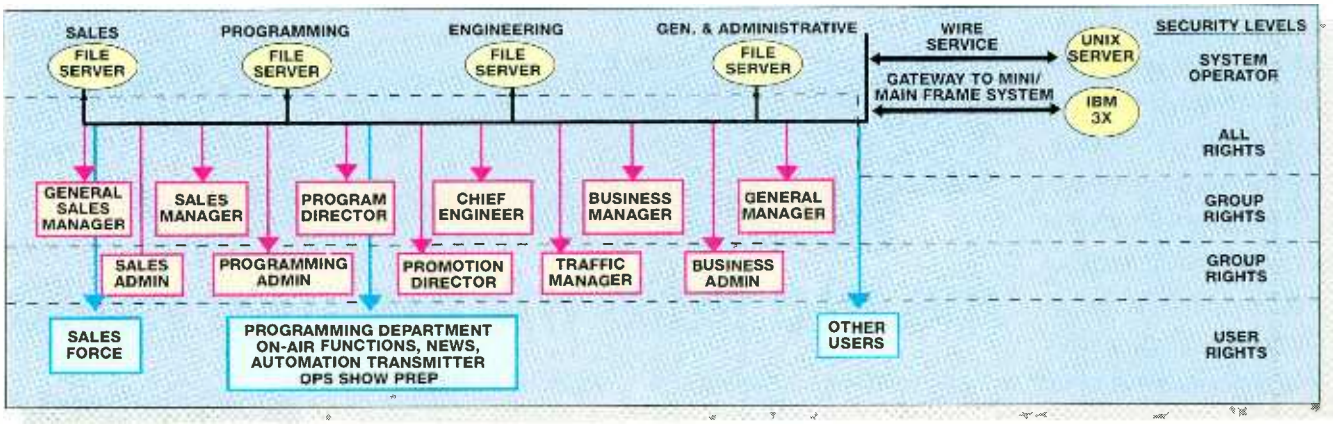


Figure 1. *A basic LAN layout for a broadcast facility. Note the various security levels and the use of servers to group common areas.*

Peer-to-peer networks

Let's say that your needs are more generic — you would like to have access to files that reside on Bob's PC, use the laser printer on Susan's desk and the CD ROM drive on Ed's machine. It would also be nice to have access to the fax/modem. A peer-to-peer network may be the solution. Any computer with a disk drive connected to the network can be a file server. Ethernet (bus or hub) is the topology of choice for interconnection.

Peer networks are easy to assemble — add an NIC to each computer, connect the cables and install the software. You can then redirect resources (disk drives, printers, CD-ROMs, modems) to and from the computers that are attached. In practice, once the redirection is assigned, the PC looks and acts as it would normally, except that there may be additional drives available. One final thing to be aware of is peer-to-peer networks offer only limited security at the directory and file levels of each PC attached. ■

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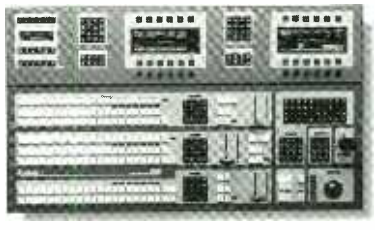

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Technology News

Power PC

By Curtis Chan

Everyone, including broadcasters, using a desktop or workstation computer will ultimately benefit from the continual improvements in CPU design. This month, we'll look at the PowerPC family and see how it compares with Intel's Pentium. The PowerPC or PPC for short, was jointly designed by Apple, IBM and Motorola. The PPC prefix is IBM's terminology, while Motorola uses the MPC (not to be confused with Multimedia PC) prefix.

RISC advantages and market challenges

Although the lines between reduced instruction set computer (RISC) and complex instruction set computer (CISC) are blurring, RISC architecture offers many fundamental benefits over CISC. Some of these benefits include small sets of simple hard-wired instructions that execute fast; *superscalar pipelined* design that breaks instruction execution into manageable steps; multiple instruction execution and intelligent large register sets to reduce RAM access needs. With regard to pipelining, the PPC's architecture divides the processing of an instruction like an assembly line process. A CPU with a single pipeline is a *scalar processor*, CPUs with multiple pipelines are called *superscalar*. Additional pipelines improve performance in a non-linear fashion because conflicts for resources frequently arise. These conflicts force the processor to freeze one or more pipelines until shared resources are available.

These benefits do not necessarily mean RISC is better than CISC in all instances, nor do the PPC's so-called technological advantages mean it will be widely accepted. Many challenges remain in order for PPC to expand into the mainstream of desktop computing.

Key differences

Let's look at some key differences between the PPC and x86/Pentium families. First, the PPC 601 is designed around a 0.6 micron, 4-metal layer CMOS process, which results in a small die size. This translates to lower manufacturing costs (as compared to the first-generation Pentium using a 0.8 micron process). The 4-metal layer process eliminates the pad ring normally surrounding a processor core, further reducing the size and cost of manufacturing. The PPC 603/604/620 will be based on a 0.5 micron process. Second, the PPC specification defines an architecture that can be implemented in several ways. Third, to Intel's advantage, the CISC Pentium is touted to be superior on almost all applications not requiring floating-point operations, which translate to most business-oriented programs. On the other hand, an RISC-based system's strength, in theory, lies in floating-point operations, which include technical, graphical and scientific software. Fourth, x86/Pentium systems have secondary caches ranging from 64k to 256k, most PPC systems have none due to their large primary cache sizes. Fifth, PPC's RISC technology uses a large register set, which lets programs store many variables on the chip, reducing memory access. Sixth, unlike x86 systems, PPC chips contain on-board variable clock multipliers, enabling them to operate at multiple frequencies internally and externally. Last, the original Pentiums consumed upward of 12W, newer versions consume 4W, and its new-generation 0.6 micron, 3.3V/4W-based Pentiums, the current PPC 601 chips operate at 8W.

PPC family tree

Just as x86 describes an entire family of CPUs, so does the PowerPC designation. There are four PowerPC entries; the PPC 601, 603, 604 and 620. Each processor places a different emphasis on performance, power consumption and price. IBM and Motorola will introduce their own versions of other PPC products including a series of embedded controllers.

The PPC 601 was designed as a strategic transitional product. It diverges slightly from the PPC architecture, in part so that it can be a better bridge to the IBM POWER (Performance Optimization With Enhanced RISC) architecture. It also runs on 3.6V instead of the 3.3V standard. It's offered at 50/66 and 80MHz speeds with power consumption around 8W for the 80MHz version.

The PPC 603 is supposed to be as fast as the 601 but will have a new design. The 603 will be optimized for use in portables and energy-saving desktop computers. It will run on 3.3V and have extensive power management features, including shutting down of all non-active portions of its circuitry. The 66/80MHz versions will use a 0.5 micron process and consume 3W.

The line between CISC and RISC is blurring.

Moving upscale, the 32-bit PPC 604, which will debut next year, promises to double the PPC 601's performance with its dual pipeline architecture. Aimed at high-end desktop, workstation and network server applications, the PPC 604 will offer vendors strong price/performance and multiprocessor capability at affordable prices.

The cream of the crop, designed to compete with Intel's P6 (Pentium's next generation), will be the 64-bit PPC 620. Expect to see similar integer performance as the 604 but with incredible floating-point capability. The PPC 620 is targeted at the extreme high end and will probably find applications in superservers and processor clusters for mainframes and supercomputers.

Conclusion

The line between CISC and RISC is blurring. The Pentium incorporates a number of features that were once the domain of RISC, like superscalar operations. Similarly, present PPC chips diverge from traditional RISC theory by incorporating more than 200 instructions (128 theoretical for RISC). The bottom line is markets are big enough for multiple players and users ultimately will decide for themselves which operating system running on which processor will be best suited for their application. ■

Chan is president of Chan and Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA.

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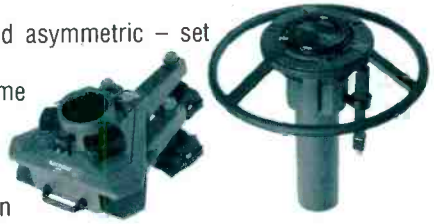

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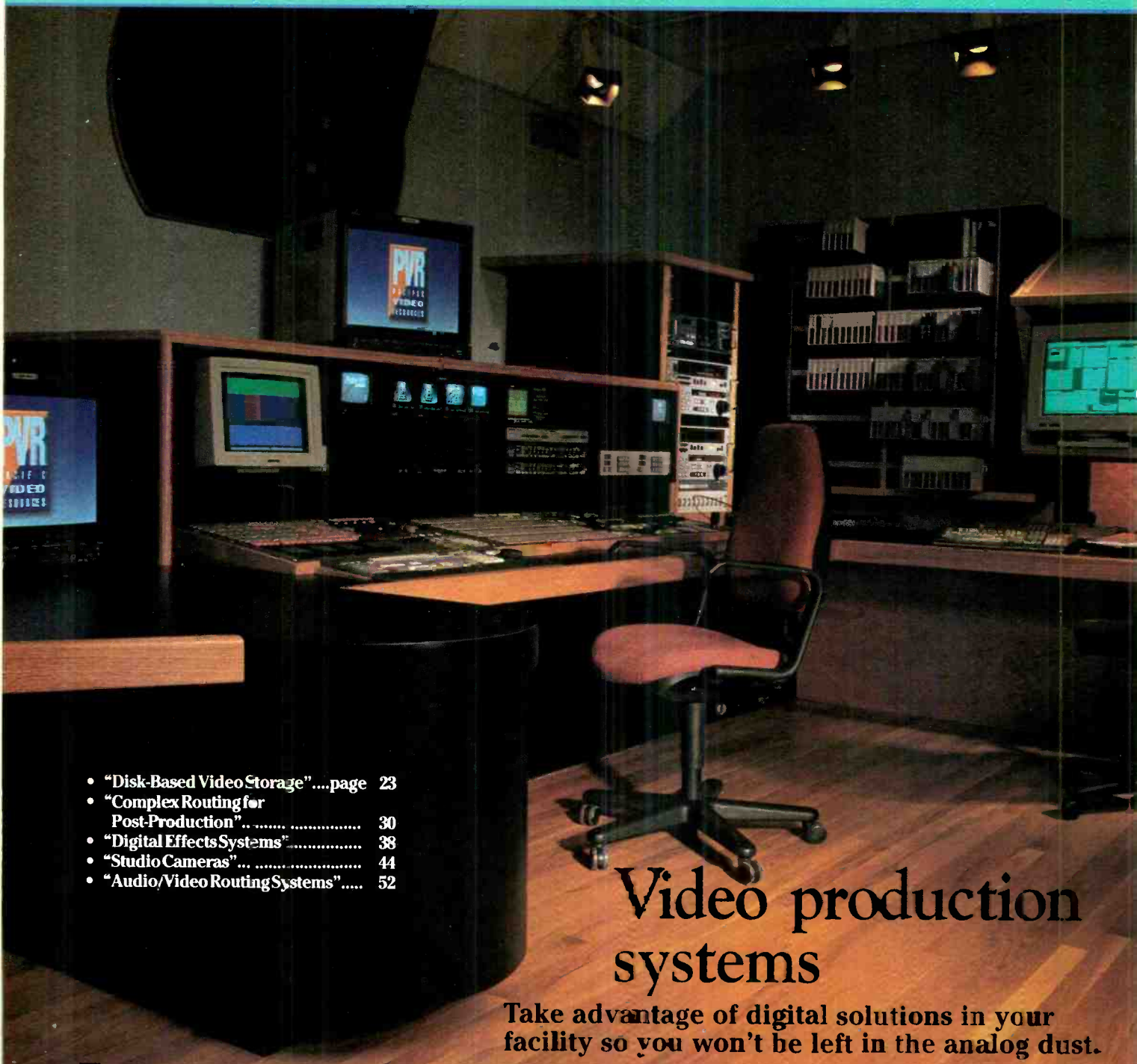

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This month's feature coverage looks at some of the hottest video technologies, DVEs, routing, cameras and the sexiest technology of them all — video servers.

And if that's not enough, *WBN*'s editor-in-chief, Jerry Walker, shows you how the World Cup Soccer matches will be covered by U.S. broadcasters. With a total projected TV audience of more than 31 billion (yes, that's billion) there's no room for error.

Maybe you're in the mood to make money. In "Wrist-Watch Profits," we'll show you how FM stations are using a new version of "Dick Tracy" watches to increase their station's revenue stream.

So don't be left in the analog dust. Learn how you can apply these ideas to your production facility or broadcast station before your competition beats you to the digital solution.

Brad Dick

Brad Dick, editor

Edit Suite #1 at Pacific Video Resources, San Francisco. One of two Complete Digital Component Editing Suites that support both D1 and Digital Betacam formats. Suites include: SONY DVS 6000 Switcher, DME 5000 and D/FX Composium graphics and effects system. Both Edit Suites can be configured for NTSC or PAL operation.

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Disk-based video storage

From desktop to video servers, disk use for video is increasing.

By David Leathers

The Bottom Line

As disk drives improve, the number of uses for the technology continues to increase. Over the last several years, hard drives have gotten large enough to store reasonable amounts of video. At the same time, disk drive arrays have gotten fast enough to play back that video at 60 fields per second. These facts, combined with the benefits of random-access and digital storage, are making it advantageous to replace tape machines with disk-based storage systems in several applications.

At this year's NAB, there were more than 100 manufacturers moving video on and off of hard drives. The applications and equipment configurations cover a wide spectrum. This acceleration in technology development is increasing exponentially as manufacturers and users gain experience in applying disk storage technology in video post-production and broadcast environments. New generations of products are appearing at every level that promise to transform operations in all video applications.

The Silicon Graphics Challenge server product family.

Desktop technology

Basic SCSI hard drive technology, the basis for mass storage in all current levels of systems, is getting predictably much better, faster and cheaper. Advances in capacity, speed and reliability along with dramatic drops in the cost per megabyte are exciting and encouraging for the continued rapid development of desktop video technology. There are now dozens of non-linear editing systems in delivery or advanced development stages that will deliver good quality video. The advances in SCSI drives and affordable RISC technology will increase the penetration of desktop solutions into professional applications.

Seagate leads the way with several dramatic products. The "Elite 9" is a fourth generation of the Elite product line, with 500,000-hour MTBF rating. It formats to about 9.1GB, depending on sector size and system requirements. It drops the cost-per-megabyte to below 50 cents for small purchase end-users. The Elite 9 has an internal data rate of up to 7.9MB/s.

The second generation of the Seagate Barracuda line, the Barracuda 4, is a 4.3GB (formatted), 3.5-inch form factor, half-height SCSI drive with a fast spindle rate of 7,200rpm. It's capable of a high sustained data rate of up to 8.7MB/s and has a MTBF rating of 800,000 hours. In the

Leathers is president of Eye Square, Hollywood, CA, and operates the *Broadcast Engineering/Video Systems* Digital Media Lab.

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year or so the Barracuda 2 (the 2.4GB little brother of the Barracuda 4) has been in the field, it has performed well in a variety of systems. The Barracudas come in SCSI, SCSI-2 fast and SCSI-2 fast and wide configurations.

In perhaps its most exciting development, Seagate is introducing 2-head parallel processing drives. These drives effectively accomplish the same functionality as using two drives in a striped array. Striping is the process of splitting data between two drives, usually on separate SCSI channels to accomplish a doubling of data throughput. The Seagate Barracuda 2 2HP and the Hawk 2LP family provide this internal striping effect within a single drive by using two heads and a buffer to move data on and off the drive twice as fast. Under optimum SCSI-2 fast/wide conditions the units are capable of processing 20MB/s.

IBM also has two high-performance SCSI drives — a 4GB and a 2GB. Both drives have a maximum data rate of 5.22MB/s. The 3.5-inch, 2GB version has an MTBF rating of 750,000 hours. The 4GB, 5.25-inch drive has an MTBF of 375,000 hours. Other drives have been introduced, notably the Micropolis AV line and a line of high-performance drives from Fujitsu, that appear to be optimized for video and audio applications.

Many random access computer video systems are not compatible with drives using thermal re-calibration (TCAL). They require drives with either no TCAL or with on-board processors that provide "smart thermal re-calibration." Smart TCAL, as it's called, will not go into re-calibration when it senses drive activity. There are a number of other issues that tend to be application and product specific. With the constant changes in both systems' requirements and drive specifications, systems integrators like Rorke Data Systems, who are video application savvy and market a wide range of products, are a good source of information.

Full bandwidth digital disk recorders

In the area of digital disk recorders, there have been significant improvements and enhancements to real-time uncompressed DDRs from Abekas and Accom.

Abekas has the new Hexus system. The Hexus combines two to six Abekas A-66 DDRs in a tower configuration. Each channel can be used by a separate workstation in a workgroup or they can be used together to provide more than six min-

Hewlett-Packard Broadcast Video Server capable of storing six hours with up to 51 hours available as an option.

Avoiding closed-captioning problems with disk-based systems

By Carlos W. Suarez

No one knows where the path of the information superhighway will end, however, several companies are working hard at building the first models. To re-tool for this highly digital world, changes within the video production and broadcast communities will need to continue accelerating rapidly. Every technology area will be touched, and closed captioning is no exception.

For real-time closed-captioning applications, the immediate impact will likely be less dramatic because captioning information can normally be merged live at the head-end. For future live or semi-live situations where merging at the head-end for some reason might not be possible, the problems of digital conversion will be the same as those for off-line closed captioning.

Technologies such as video servers and non-linear editing systems are generally geared more toward off-line production environments. In those environments, closed captioning is performed on specialized SMPTE-time-code-based, off-line editing equipment. Whether for real-time (live) or off-line applications, whenever information is converted into digital format, the system design must preserve the closed-captioning data or it will be lost.

Several companies have announced initial implementations of video servers. Most of the methods being implemented today require the digitization, compression and transmission of the original video from the head-end. The information is decompressed at the receiving end. Generally, some sort of motion compression technique is implemented. In all cases explored, the method used was MPEG or MPEG II. Unfortunately, when the information is compressed in this manner, the closed-captioning information generally is lost. To get around this, captioning information needs to be treated as a separate datastream within the MPEG specification.

Several server vendors were contacted for this article. Silicon Graphics of Mountain View, CA, is providing software for the video server and setback boxes, as well as the server itself for the Time Warner Cable trial. This trial is scheduled for first phase implementation later this year. According to Jim Barton, general manager of Silicon Graphic's Broadcast Group, closed captioning will not be addressed until the second release. He does not perceive that supporting closed captioning will be a difficult technical issue and believes it can be solved by implementing minor software changes. The date for the second release has not been set.

Another vendor, Philips Consumer Electronics of Knoxville, TN, is developing software for the highly publicized Bell Atlantic trials in Washington, DC. Brian Smith, vice president of market development for video communications explained that closed-captioning support is built into its first release.

For digital non-linear editing applications, support of closed captioning is considered somewhat less of a priority. The key vendors developing off-line editing products are at early stages in their development processes for implementation of closed captioning. Currently, after the video has been edited on a non-linear editing system, it is closed captioned using an off-line caption editing system. This 2-system process works well for many applications. However, this methodal ways requires re-editing the material through an off-line captioning system when additional changes are needed. Representatives at Avid Technology and Matrox were contacted for this article. Avid explained that it is exploring methods for dealing with closed-captioning information directly from within the product. The company was clear that we will need to look to future releases of the company's products before we will see this capability designed in. Matrox is also reviewing how to add this capability to its systems. ❑

Suarez is principal of the Naples Cupertino Group, a marketing and technology consulting service for interactive television and media technology, Santa Clara, CA.

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Media Pool is the video server system from BTS that is shattering everyone's idea of what tapeless recording should be. BTS for the first time revealed idea shattering features such as:

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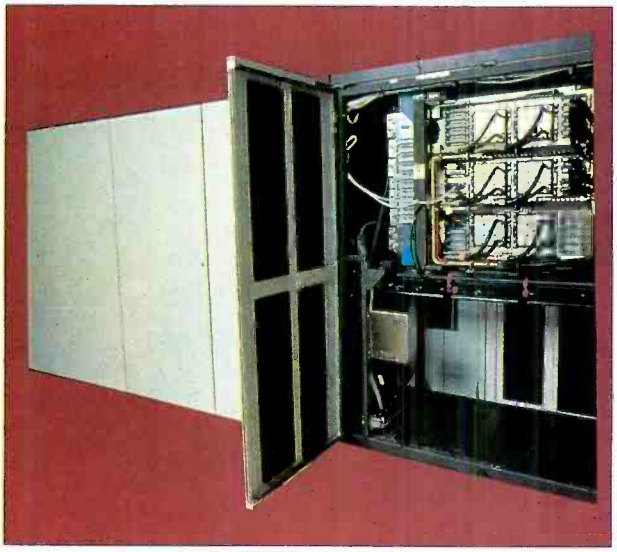
utes of uncompressed D-1 instantly accessible and controllable storage. The Hexus is controlled either via ethernet or D-1/RS-422 links.

Accom has the innovative Work Station Disk (WSD). The WSD has a capacity of 32 seconds of uncompressed D-1 video. In addition to ethernet, D-1, RS-422 and RS-232 ports, it has a direct SCSI interface for the workstation. This creates a much faster interface than ethernet, or the frame-by-frame transfer process currently used to move uncompressed video directly on and off workstation hard drives. Because the drive/bus/processor combinations currently available in desktop systems cannot process data at rates sufficient for real-time video transfer, the WSD SCSI interface becomes the best alternative for moving uncompressed video on and off the desktop. The WSD interface also allows control of an external video device from the WSD keyboard. This means the workstation operator can move data/video between a tape machine, the WSD and the workstation without having other control systems involved in the process.



IBM-9000 scalable video servers based on IBM's ES/9000 series are capable of serving thousands of simultaneous video-multimedia streams.

There is a relatively new generation of video DDRs built on desktop computer platforms. Sierra Design Labs has a family of real-time digital disk recorders called Quick-Frame. Quick-Frame systems come in a range of configurations with or without compression. The newest entry is the Quick-Frame EX24 that provides almost 24 minutes of uncompressed 8-bit D-1 in 5 1/4 inches of rack space. The system will support expansion units for up to 180 minutes of storage. It supports VTR-compatible RS-422 control, true nonlinear playback, 8/10 bit and 525/625 selectable video formats and has ethernet and multifunction SCSI interfaces. The Quick-Frame EL line, which has been shipping since mid-1993, starts at a 3-minute capacity.

Hewlett-Packard has developed a 4:2:2 video disk recorder that was developed jointly with Sierra Design Labs. It uses Sony Betacam RS-422 control protocol and stores three, six or 12 minutes of uncompressed D-1 video, depending on configuration.

Advanced Digital Imaging's Digital Magic system uses the Intelligent Resources Video Explorer card for D-1 input and output to a high-performance Macintosh subsystem that provides up to 8.5 minutes of real-time 8:1 compressed D-1 or Betacam quality on specially configured 2.4GB Fujitsu SCSI-2 disk drives. It is capable of motion JPEG compression ratios as low as 3:1. Multiple drives can be added to the system to expand the compressed storage capacity to more than an hour of compressed D-1. It is compatible with the Mac environment and works as a video device in real time. The quality of the Video Explorer card and the low compression ratios make it a practical device in the most demanding environments.

ASC of Burbank, CA, has introduced the Virtual Recorder (VR). The VR is a digital random access storage system. It has Betacam component, RGB, S-video and composite video I/Os and two channels of 16-bit audio in and out. Video is stored at compression ratios that are dynamically variable to accommodate quality or data rate requirements up to 8:1. The Virtual Recorder is rapidly catching on as a way to provide random access "video for audio" to digital audio workstations.

Video servers

Different perspectives on exactly what a video server is provide different definitions. One way to look at it is mechanical, that is an inventory of the components. A typical video server might include one or more fast processors, a large array of mass storage devices in a RAID or other high throughput configuration and a solid-state buffer for real-time video and audio outputs. Other components may include internal processing schemes for uncompressed D-1 video and various MPEG and/or JPEG compression, interfaces for multiple inputs, outputs workstations and terminals.

Microsoft unleashes its Tiger

By Carlos W. Suarez

Microsoft has recently entered the "server" game with the announcement of its Tiger media server technology. The software is based on the Windows NT advanced server operating system. Tiger software is designed to be flexible, scalable, reliable and cost-effective. The number of servers implemented can be scaled up as needed from one to virtually any number. Tiger is designed to be hardware independent and deployable across a wide range of hardware. Distribution media can include cable television, LANs, WANs or telecommunications networks.

The server software is one of the first major server announcements that can be implemented on lower-cost PC processor technology. Microsoft believes many applications will not require the higher cost and performance platforms. With this design, multiple low-cost servers can be linked and controlled by the Tiger software so they function as a single, virtual massive server. Because of its inherent scalability, additional servers can be easily added as required by the application.

Using a proprietary file system, Microsoft claims to have achieved greater reliability and solved the inherent problems of continuous-media servers. The file system allows for bits of files to be stored over an array of storage devices. Two copies of each video file are stored across the storage media. Microsoft believes that this method is as effective and less expensive than other redundancy methods. Fault tolerance is provided through the distributed system design, no single failure will stop the system. If a disk fails, the system will compensate by redirecting the data, the same is true if a disk server fails.

Intel, Compaq and General Instrument have announced plans to implement this technology for video server applications. Intel recently demonstrated a video-on-demand application on its scalable multiserver. The configuration used 16 Pentium-based nodes capable of delivering more than 3,000 simultaneous video streams with full VCR control. The demonstration system also included 64GB of hard disk capacity capable of storing more than 50 feature-length films.

General Instrument plans to develop solutions for the cable head-end, the broadband network and the in-home set-top interactive terminal using the Tiger architecture. A first-generation interactive terminal for multimedia applications is being developed that will deliver introductory interactive services including programming guides, video-on-demand and home shopping. ❑

Suarez is principal of the Naples Cupertino Group, a marketing and technology consulting service for interactive television and media technology, Santa Clara, CA.

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The Media Pool from BTS, a fully redundant media server developed for broadcast and post-production. Compression can be used if desired, but is not required.

From the system's perspective, a server may be defined as a highly accessible, large-capacity random access storage device that ties together a number of workstations and their functions. With today's technology, this can be a dangerous perspective. Users who expect to find a server in the form of a box that they can use to tie together several disparate hardware and software systems to share data and increase productivity are likely to be disappointed. Standards and systems continue to evolve and many of the cross-platform and even cross-application incompatibilities with the same platform make it difficult at best to use servers as the glue that is hoped for.

Perhaps because of this, there is an emerging trend toward the development of large, dedicated array systems under single manufacturers with the processing, software, electronics and storage to provide hundreds of hours of random access full-bandwidth storage that is instantly and simultaneously available in a multi-user, multiworkstation environment.

Silicon Graphics has the Challenge servers as part of its developing Silicon Studio approach to building a video environment on its Onyx line. Actually, the full range of Silicon Graphics workstations can be tied together on a network. As the video I/O capabilities of Serius video becomes available to the larger systems and Galileo video for the Indigo 2 system, a true all-encompassing video solution is conceivable. Many of the software applications on SGI are already operating at the most advanced levels. The Challenge servers can accommodate up to 32 hours of uncompressed D-1 video.

Ciprico has the Spectra 6000 disk arrays. Using hot-swappable RAID technology, they can be configured up to 16GB per unit. It is available in a variety of configurations and provides transfer rates in the 19MB/s range. It is designed to work with and has software drivers available for the full range of SGI workstations.

Broadcast uses

The Dynatech DigiStore is a multichannel all-digital video spot playback machine. With seven systems in the field, it is the leading system of its type today. A single DigiStore unit can have as many as 14 2GB (9GB soon) drives on each of three channels. It provides instantaneous and programmable access to hours of high-quality storage at variable compression ratios. It is compatible with other automation systems and also does program delay duties.

Avid's disk-based AirPlay system is now in use in two stations. The AirPlay provides random access to clips, spots, bumpers, opens, closes and standbys.

Channelmatic offers the Adcart/D digital ad insertion system. It promises to be a high-performance, cost-effective system that interfaces with a variety of software modules for traffic and verification.

BTS has announced the Media Pool. The Media Pool promises to take the concept a step further with a system that can be scaled up to include access to hundreds of hours of storage that can be accessed by up to 16 workstations or terminals simultaneously at full bandwidth. It also will feature various compression ratios. The system, which is expected to deliver this year, will initially have all the components for spot insertion and management, program delay and VTR emulation.

Tektronix has introduced the Profile, designed and built around off-the-shelf components. Profile is capable of up to four channels of digital or analog video, with up to four audio channels

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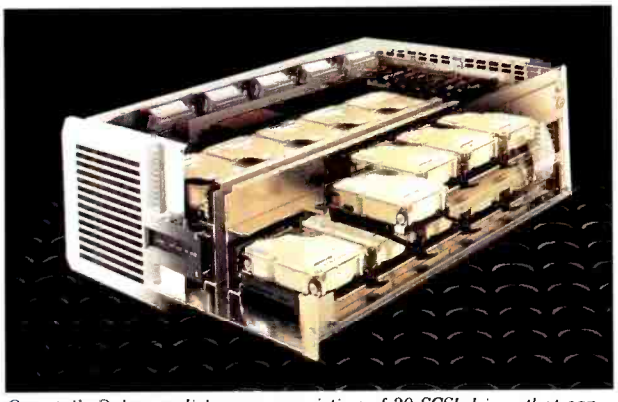
The major advantage to storing video and audio hard drives is the speed and convenience of random access.



Quantel's Dylan, a disk array consisting of 20 SCSI drives that can deliver CCIR 601 images at faster than video rates.

per video channel.

Disk-based video is not limited to a specific application. As the technology continues to improve, expect to see these systems in a wide variety of uses, and doing a lot of the work currently being done by tape-based systems.

Beyond disk-based storage

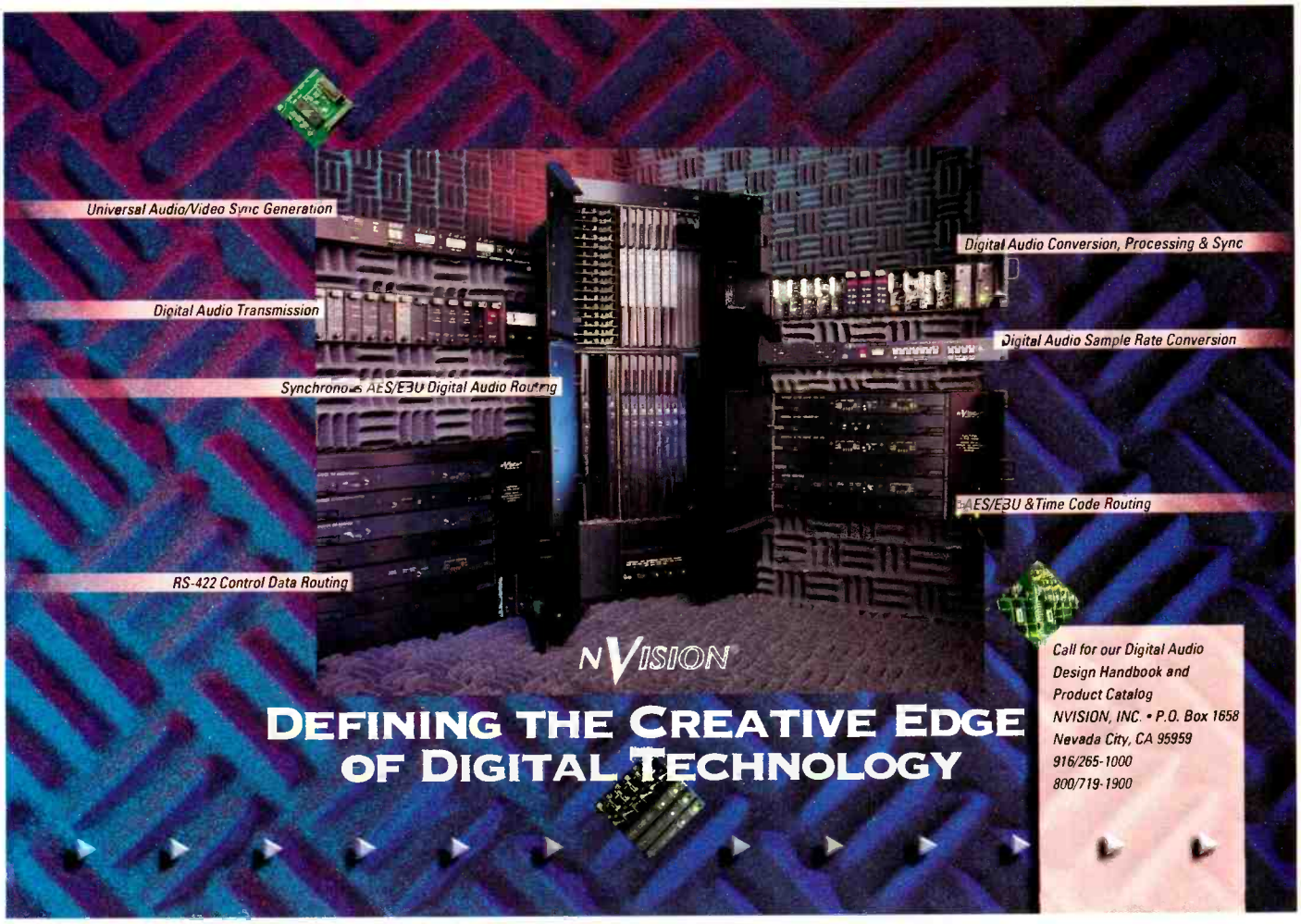
The major advantage to storing video and audio hard drives is the speed and convenience of random access. However, while disk drives are looking to replace linear tape-based technologies in many applications, they still leave some issues unaddressed.

Cost of storage, system flexibility and compatibility between systems and sites are all concerns in today's applications. Removable magneto-optical disk technologies are in limited use in video today. They are improving in performance and can add to a system's flexibility. However, they still lack the speed required for highest performance of many systems and are not yet available in multigigabyte sizes.

Disk drives are complex mechanical devices that have numerous moving parts and consume a significant amount of power. A new generation of storage products based on holography is being developed. (See "Technology News," February 1994.) Holographic storage involves scanning special multilayered media with lasers. Storage density is already 10 times greater than current magneto-optical or optical recording technologies. Holographic storage devices also have few moving parts and low power consumption. As work proceeds on these devices, rapid improvements are possible, as is the likelihood this technology will be of interest to broadcasters in the future.

Editor's note: For additional information, see "Video Servers," May 1994; Applied Technology, Tektronix Profile, this issue, pg. 80; and the upcoming Applied Technoogy on the Quantel Clipbox in July. ■

➡ *For more information on disk-based video storage, circle (339) on Reply Card.*



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Complex routing for post-production

Creating a unified control system solves many of the problems.

By Andrew Delle

The Bottom Line

With the wide variety of equipment available, the number of possible facility configurations is almost infinite. Tying the equipment together can be a daunting task. Faced with the problem and given the resources to solve it, custom hardware and software can be used to streamline operations to the benefit of all concerned. Despite the up-front costs, the payback can be significant and long-term, making the overall process cost-effective.

$

In 1974 The Post Group was founded in Los Angeles. By 1990, the company had outgrown its primary facility and digital technology needed to be incorporated into the operation. A separate facility was built to house the digital equipment while the primary facility continued to house the analog edit bays. This arrangement worked fine until 1992.

The marketplace became saturated, and efficiency and labor costs became new concerns for management. It was decided to renovate the primary editing facility cosmetically and technically in two phases. Phase one required rearranging public space along with a complete technical rebuild. Phase two involved moving the D-1 edit bays to consolidate all editing under one roof.

Designing for efficiency

Operational efficiency simply had to improve. The facility's large routing matrices were all controlled separately. In addition, too much equipment was accessible only by direct patching. The router's final equipment load was determined to be more than 60 broadcast VTRs, 11 channels of DVE, 13 digital disk recorders and eight channels of character generation. This equipment would feed the switchers for eight edit bays.

The Post Group has always avoided dedicating equipment to a particular room. Today's multitude of tape formats makes this an even more complex problem. The new facility needed to be designed around one unified routing system, not necessarily one routing switcher, but one central control network that appears as one router to operators. The system required custom software and hardware unavailable from any manufacturer.

Designing custom software and hardware was nothing new at The Post Group. Several specialized routing systems had been developed over the years. The next step was to design a system that incorporated all these old ideas into one system. The system incorporates 23 separate matrices from 192x160 to 8x4. The control system consists of 16 IBM PCs networked to two industrial computers then to the matrices via standard RS-232/422 serial ports.

Delle is vice president of engineering for The Post Group, Los Angeles, CA.

Custom panels were rejected quickly due to the rigid design rules dictated when you cut holes in metal.

Human interfaces

Various human interfaces were studied including custom control panels, CRT/keyboard terminals, mouse-driven "Window" programs, and touchscreens. Custom panels were rejected quickly due to the rigid design rules dictated when you cut holes in metal. The interface had to be flexible and reconfigurable. Text-based CRT terminals were deemed awkward because of the numerous keystrokes required. A Windows program would be state-of-the-art, but required operator training and substantial memory and CPU horsepower to achieve the needed operational speed. Touchscreens were select-

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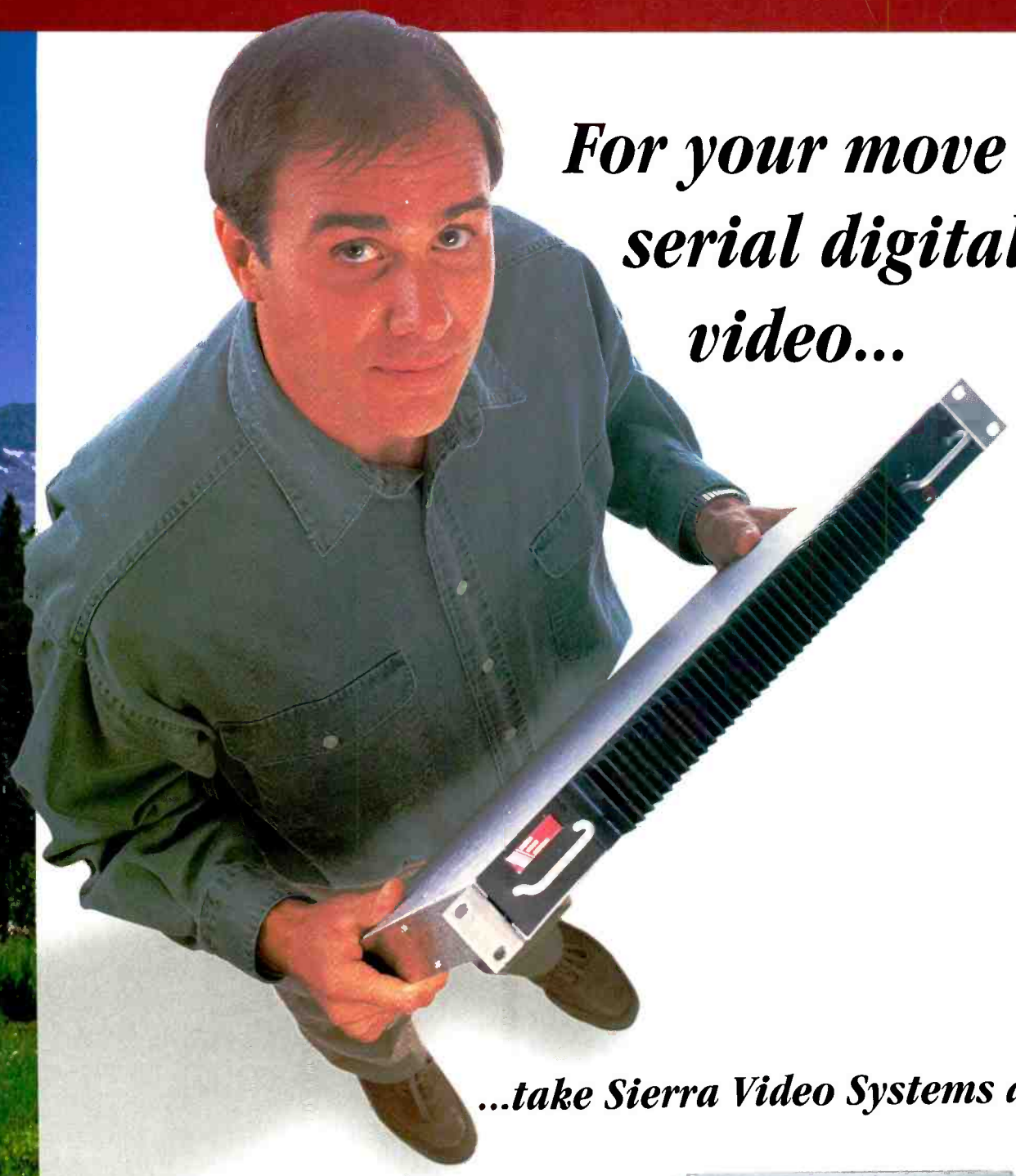

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In 1992, we launched the Sci-Fi Channel, now in 15 million homes nationally, and in April, 1994 we will launch USA Network for Latin America. The Sci-Fi Channel formula blends classic favorites and contemporary off-network sci-fi shows. Its movies are theatrical blockbusters and original productions that are part of our "Planetary Premieres" series.

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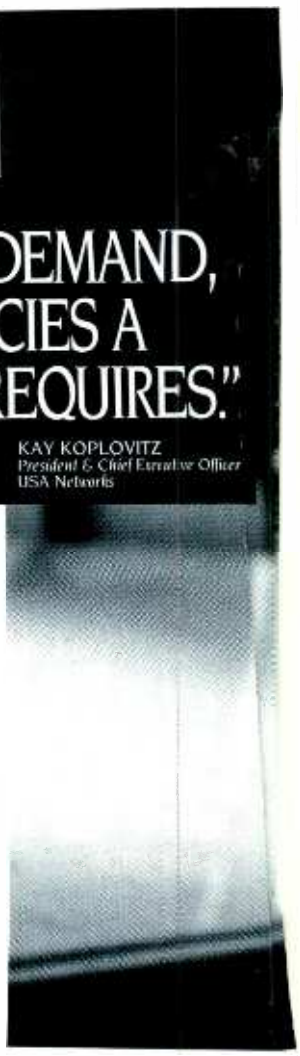

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Panasonic believes that digital composite and component signal equipment will continue to co-exist for many years. The company sees interrelated D-3/D-5 facilities with each equipment performing the tasks to which it is best suited.

Kay Koplovitz is founder, president and chief executive officer of USA Networks. She continues to be one of America's most influential corporate executives, charting new territory and keeping her network in the vanguard of the television industry.

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It's the industry's visionaries who see an all-clear path to the future.

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Continued from page 32

3. Control panel input from edit bay (RS-485)
4. Timeline control from the edit controller (RS-422)
5. Timeline control from the A84 D-1 switcher (RS-485)
6. Menu video output (analog video)

Each of these signals requires a separate "patch" to move this DVE from one room to another. The margin for error plus the time required to reconfigure is quite high. In our system, an operator or editor touches the DVE icon for that device and the desired bay channel position. All the signals are switched within 1/30th of a second.

Additional control capabilities

Another feature of the software is automated PAL/NTSC switching. The D-1 bays are dual standard, an efficient means to switch between standards was needed. Switching reference black is done by an analog router. However, this is only part of the problem. Much of the dual standard equipment requires internal DIP switches to be changed and the CPUs reset. Normally this means calling an engineer to power down, remove cards, and restore operation to each device. To address this, all devices have been modified with relays or open collector circuits to allow remote switching. These circuits are wired to a large GPI device on the router network. When a room is switched to another standard, the equipment assigned is automatically switched and reset within seconds.

Another feature of the software is integrated TBC control. Although there are several good systems on the market, none of them provided a total unified interface to the router. The staff wanted to be able to control a machine's TBC from any location without having to work with two control panels and fighting with time sharing within the TBC control systems router. The ARCNET network has sufficient bandwidth to support several stations controlling many TBCs in real time. The level control device or "pot" is a trackball integrated into the workstation keyboard.

The keyboard is also used to type in personalized names for the level memories rather than simply numbering them. Ten memories are provided for every machine at each station exclusively, plus they can be copied to any other station. More than 60 interfaces were designed and built from the component level up to interface with the various tape machines. These custom interfaces are self-configuring for the type of machine connected, i.e. analog voltage or RS-422 control interface. Any changes including the front panel of the tape machine are copied to all stations eliminating the need for exclusive lock-outs.

With all facility functions under the supervision of one system a tally system was implemented for all tape machines. The EWT (electronic white tape) displays above each VTR indicate the controlling source, the status of the destination lock, and the video standard being supplied to the VTR (PAL/NTSC). The display consists of an 8-character 0.6-inch LED display linked through a separate RS-422 receive-only network. The physical interface is simple RJ11 telephone wire looped though each display. These devices were also fabricated in-house due to the custom requirements.

A close-up of one of the touchscreen workstations, note the EWT displays in the background.

Hardware components

The physical hardware of this control system can be broken down into three major sections: high-level controllers, low-level controllers, and sub low-level controllers. High-level controllers are the actual touchscreen computers. Each computer has the operating program on its own disk. It is important to realize the network is merely a high-speed data transport medium. There is no "file server" as with most computer networks. Other high-level controllers include the TBC interfaces, the PAL/NTSC switcher controller, and the EWT display controller. These devices communicate with our proprietary ARCNET protocol.

Also on the ARCNET network are the two I/O processors (primary and standby). Although the system contains no central file server, there still must be some place to store the master crosspoint status. These industrial computers hold this and also provide protocol conversion from the network to the individual manufacturer's matrices. From these computers, 20 RS-232 ports connect to the routers through a changeover switch, a simple relay array with diode control logic for reliability.

The low-level controllers are custom interfaces used where a matrix does not have an RS-232/422 port. Custom microcontrollers are fabricated with an RS-232 input and parallel outputs to control routers, such as the Grass Valley DPM1325 8x4. Sub low-level controllers are supplied by the router frame manufacturers as required. Because our physical router system is made by Utah Scientific, our RS-232 output talks to its PL320 controllers, which in turn, drive the matrices with proprietary protocol.

The key here is redundancy and reliability. With a system this large, you can only imagine the financial repercussions of a single-point failure. The software was carefully written to prevent this. Any touchscreen computer may fail but will affect only that station. Stations may depart from or join the network without any disruption to the system. As mentioned, the two I/O processors are redundant through a relay switcher. Sub low-level controllers have their own backups as provided by the manufacturers.

ARCNET distribution was carefully designed to reduce the effects of cable breakage or shorts. All of the custom interfaces have spare cards in inventory to circumvent extended down time. A single matrix may fail but complete system failure for any length of time is not likely. The post-production business can tolerate downtime measured in minutes without substantial revenue loss. Broadcasters, on the other hand, cannot afford signal loss at any time. The design outlined could be further enhanced to provide absolute on-line redundancy.

Because of its roots in heavy industry, ARCNET is extremely resilient and reliable.

At the beginning of this article we mentioned the need to increase operational efficiency. Since the commissioning of this system, downtime relating to equipment setup and configuration has been virtually eliminated. Although the costs in materials and man-hours to design and build such a system may be high, the revenue savings paid back will offset these costs several fold. In addition, other factors that contribute to the bottom line, but can't be directly measured, include staff morale and client satisfaction. ■

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Digital effects systems

Getting away from the black box.

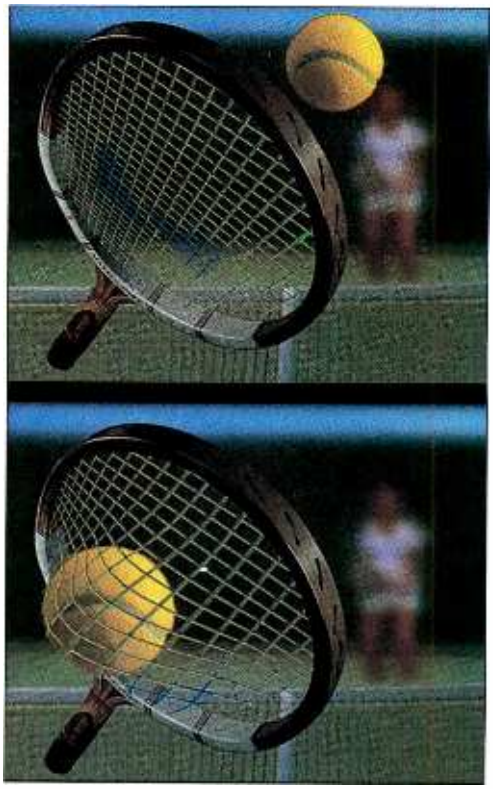
By Curtis Chan

The Bottom Line

Digital video effects units were once proprietary black boxes. Today, many of those black boxes have been replaced by high-performance computers, running specialized software. Many standard DVE moves can be accomplished on today's desktop systems simply by adding the right software. However, the high-end still exists. Top-of-the-line DVEs are capable of sophisticated real-time effects that were only dreamed of just a few years ago.

The age of interconnected proprietary black boxes is rapidly drawing to a close. Except for high-end products selling to boutique markets, the domain of low- to mid-market black boxes has given way to cross-compatible computer platforms integrated with the latest generation of plug-ins and running customized software. This article will focus on how DVEs are becoming more software-based, and what's new in the latest generation of high-end DVEs.

Improvements in chip design and fabrication technology have allowed DVE manufacturers to integrate high-end performance features onto silicon, resulting in greater cost efficiencies. The next generation of DSP ASICs will make it cost efficient to simply develop code and port it over to a common computer platform. Consider that one day in the near future, it is possible the production environment might be nothing more than multiple workstations linked to a massive client/server network.



A digital video effect done on a high-end effects system. (Photo courtesy of Quantel.)

Market realities

It simply boils down to money and the economics of doing business. First, realize that much of the latest technology within this industry is borrowed from larger markets, such as the computer or information technology industries. Second, the computer industry has generously supplied us with established computing, connectivity and operating system platforms. Because there are multiple sources for vendors, DVE companies can realize the benefits of shortened development times. Last, the financial leap-of-faith is small if a company invests in the development of code rather than fronting capital costs for product development and manufacturing.

It wasn't all that long ago that DVEs (and

Chan is president of Chan and Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA.

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any other production equipment) were built on the philosophies of "one button, one function" and "size is proportional to price." The result was a control panel or black box with an assortment of blinking lights, buttons, knobs and sometimes a joystick. The control panel was usually connected to a rack-mount unit, which could take an entire rack. Unlike today's software-based systems, updates were rare and new effects were a long time coming.

Then, small entrepreneurial companies started to spring up with hybrid DVE systems based on commercial-off-the-shelf computer platforms. These were coupled with DSP technology and controlled by software. At the same time, companies began offering feature-rich video plug-ins for the masses. Combined with powerful code, these DVEs sparked a revolution toward low-cost, performance-oriented products.

Software and DSP advantages

Using a common computer platform comprised of dedicated plug-ins for the host, an add-on processor for the necessary video operations and controlling it with powerful code, has several advantages. One primary benefit of coupling powerful software to a computer is the ability to emulate specific control functions. The computer's keyboard and mouse with an optional dedicated controller is usually all that's needed. GUI's offer two additional benefits: 1) powerful performance features can be mapped on the screen using menus, dedicated icons and submenus, and 2) software updates are easily added. Instead of dedicated hard keys, soft keys combined with menu parameters allow instant access to multiple functions.

The computer also allows for the integration of 3-D modeling and animation software with real-time digital effects. Because the software and processor share the same frame, sophisticated effects rivaling much larger systems can be performed. Another benefit is the raw processing power of the new generation of CPUs/DSPs on the market. Three-D rendering times are significantly improved as is the level of filtering and motion prediction emulated through software and DSP. Furthermore, options are easier to design because of the common communications backbone. Plug-ins might include an add-on still-store or a full bandwidth key channel for added effects, newer DVEs support 4:3 and 16:9 operation.

Higher-end improvements

The advancement in DSP and software design have also allowed for proprietary high-speed processing with novel approaches to digital filtering. Such progress has given way to systems being able to support up to 10-bit 4:2:2:4 (upsampling to 8:4:4:8) processing with real-time 3-D capability along with numerous upgradable effects. High-quality anti-aliasing filters reduce noise components. Faster processing times combined with DSP/software also allow for frame/field-based processing in DVEs. Newer systems also offer selection of digital serial component/composite inputs and outputs for pristine video quality.

Being in a not-so-perfect world with multiple formats, system flexibility would be a godsend. To this end, several companies offer analog and digital component and composite I/O. In digital component, systems can switch between 525/60 and 625/50. With built-in routers, DVEs can accommodate multiple inputs per channel and, in some cases, control external switcher buses giving programmable input control to the front or back of the DVE channel. In addition, high-end systems usually employ internal sync generators that allow the system to genlock to color black or bars and memorize source timing on an input-by-input basis. This feature allows transformed images to be sent to a switcher for "upstream" manipulation or allows the transformed images to be re-timed to the output of a switcher in a "downstream" mode. Last, high-end systems are designed to interface to the real world much easier than their lower-priced cousins. For instance, most high-end systems have comprehensive interfaces that provide flexibility in controlling external input selectors, edit controllers, switchers and routers.

A "Rubik's cube" effect done on a mid- to high-end system. (Photo courtesy of Microtime.)

Screen-shot of a 16:9 page-turn effect within a 4:3 image. (Photo courtesy of Abekas.)

Effects, effects and effects

One of the things you won't find lacking in high-end systems is the endless stream of upgradable effects. Aside from standard effects, recursive, lighting and non-linear effects are on the rise. Recursive effects, such as trail, motion-decay, multifreeze, time strobe and keyframe strobe can be accommodated. Good DVEs also give independent control over each effect. On the non-linear side, new effects are coming like wave, flag, ripple, rings, mosaic glass, split slide, defocus and sepia. Together with lighting and shading effects control, modifiers, such as intensity, pattern, position and color allow precise image creation resulting in 3-D realism for non-linear effects.

The degree of control and the specialization of the effects are also what sets high-end systems apart. Aside from controlling each effect's attributes, such features as keyframe storage add to the overall value. With most functions, intermediate values between the keyframes are automatically calculated and trajectories interpolated to complete the sequence. Motion paths between keyframes can be quickly modified. Various types of motion paths, such as linear, spline, smooth and step are available. Independent function time line processing gives higher control flexibility. Newer systems also incorporate world and set camera views, letting the user manipulate each image in source, target, 'world' or camera space.

Epilogue

The advancements in software-controlled DVE devices will continue at a rapid pace. Parallel advancements in DSP/CPU design, along with higher-power computers will give rise to a new generation of cost-effective DVEs for the low-to-mid end markets. For the high-end, computer-based client/server technology may replace the separate functionalities of the DVE/switcher/editor within the next half decade. It's going to be a bumpy ride, but with profitable opportunities for the visionary companies. ■

For more information on digital video effects, circle (336) on Reply Card. See also "Digital Video Effects Systems" on p. 61 of the BE Buyers Guide.

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As post and broadcast facilities upgrade their systems, many are turning to serial digital video technology. Although such systems offer many advantages, they require new design and construction skills from the engineering manager. The August issue of *Broadcast Engineering* magazine will provide the guidance needed to properly design and build your facility's new serial digital suite or master control room. Don't miss this important "clip-and-save" feature article.

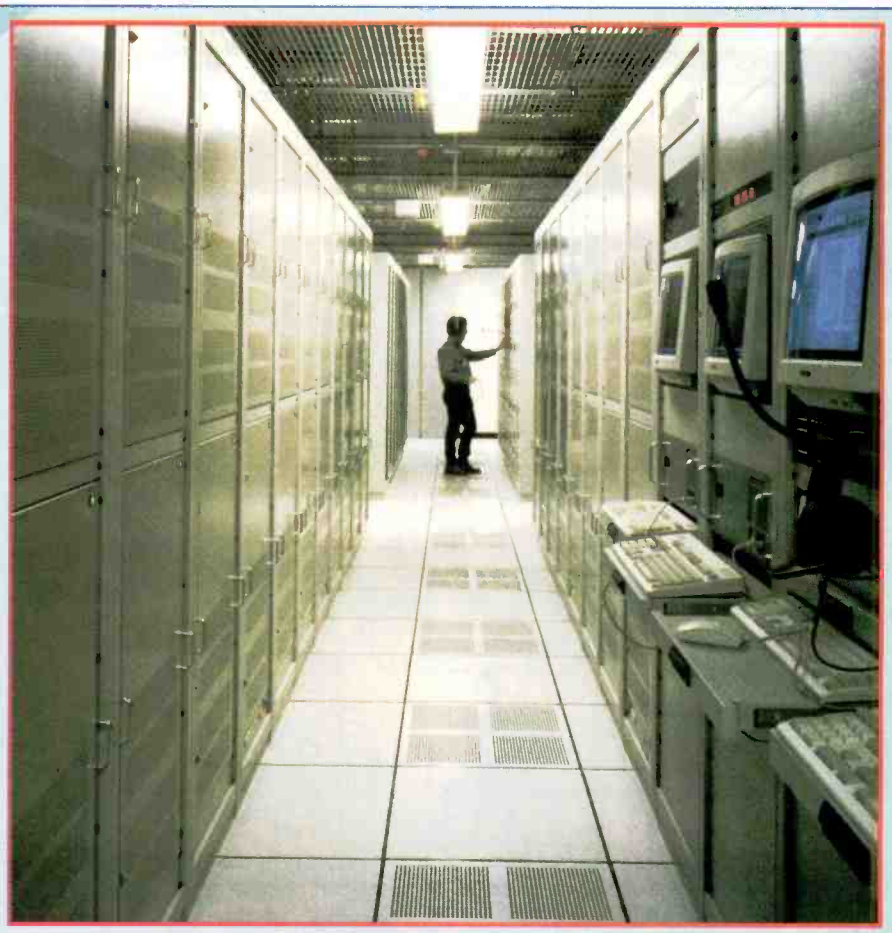

Photo at right: *One of the latest high-tech installations to use serial digital video technology is the DirectTV facility in Castle Rock, CO. The serial digital routing system, installed by Sony System Integration Division, is among the world's largest. It consists of five interconnected matrices — the largest of which is a 512x512 serial digital router.*

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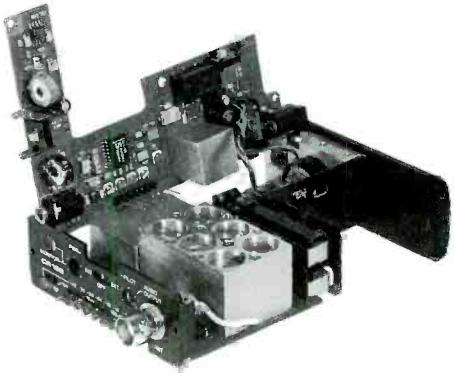

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Studio cameras

High tech, advanced features and smarter heads combine to make better pictures.

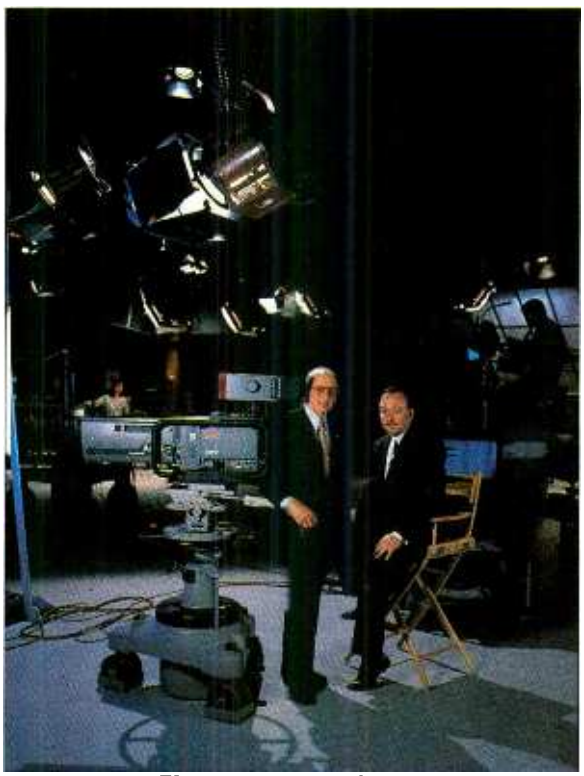
By Marcus Weise

The Bottom Line

For years the studio camera has defined the "look" of a facility. Newscasts, promotions and commercials have all been shot through the "eye" of studio cameras. Quality images are primary to a facility's success, and one of the best ways to achieve them is through a top-of-the-line studio camera.

In the past year there have been some interesting advances in studio cameras, in both lenses and camera electronics. The new generation of cameras comes with greatly enhanced capabilities, greatly reduced weight and little change in price. Cameras can output digital and analog signals in both 4:3 and 16:9 formats. In addition, they can accommodate extraordinarily long cable runs without signal deterioration. This article will look at how these new features have changed the studio camera.

Cameras can output digital and analog signals in both 4:3 and 16:9 formats.



A newly installed BTS LDK-10 at Metropolis Studios, New York. Pictured with the camera are Philip J. Mancino, Metropolis executive vice president (left) and Robert C. Weisberger, Metropolis president and CEO.

Lens technology

Because the camera output is no better than its input, current lens technology needs to be considered. A standard lens has a dome shaped or spherical cross section. Light passing through a spherical lens does not all focus at the same point on the focal plane. This causes distortions including spherical aberration, chromatic aberration and geometric distortion.

These aberrations are nothing new and are traditionally corrected by adding additional elements to the lens. The development of the aspherical lens shape is an attempt to correct these problems without adding new ones. The aspherical

Weise is president of Marcus and Associates, Hollywood, CA.

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The Thomson Broadcast TTV1544.

shape can be varied or customized to meet the needs of the lens or the job required. However, the basic concept is to focus all the light rays at the same point on the focal plane.

Improvements in glass composition have also created an increase in resolution and a decrease in chromatic aberration or color distortion that naturally occurs when light passes through the lens. This improved glass allows a lens formerly used only in 4:3 to be used in 16:9 as well. Because of its capacity for increased resolution, the 16:9 format is much more demanding of lenses.

Several companies have created diagnostic programs or software for their cameras and lenses. These programs make it possible to troubleshoot and service these units quickly. By hooking into a computer, the diagnostic functions can be carried out remotely. Also, a running track record can be kept if desired. The results can be sent by modem to the manufacturer in the event the problem cannot be fixed locally. Technicians can then analyze the problem and make suggestions to correct it.

Flesh tone detail allows color correction of the flesh tones independent of the rest of the colors in the picture.

Camera technology

The quality of CCD chips has improved, increasing density and resolving capabilities. New CCDs feature 900 lines or more of resolution. Combined with camera signal path bandwidths of 12MHz for green and 10MHz each for red and blue, these CCDs can produce a high quality image. Both triax and fiber systems are available. The optical fiber systems available for some cameras offer true digital transmission.

Another feature is picture-in-picture (PIP) in the viewfinder, which allows the operator to see other images the control room wants to send. PIP's might include special effects setups so the camera operator can set framing and still have the camera shot in the viewfinder.

The AQ-235W from Panasonic is 16:9/4:3 switchable.

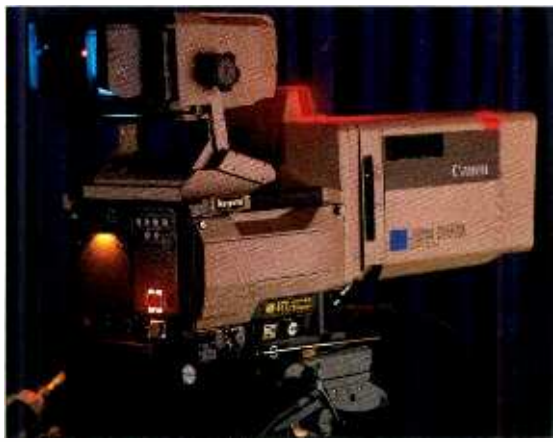
Cameras have through-the-lens auto-setup systems. They also have a great deal of video correction capability, such as flesh tone detail, 6-vector color correction and automatic digital shading correction. Flesh tone detail allows color correction of just the flesh tones independent of the rest of the colors in the picture. Because we are sensitive to what true skin tones are and not as concerned with the colors that make up the rest of the picture this becomes a desirable feature in color correction.

Many manufacturers are using 2/3-inch chips for their studio cameras. The larger the chip the more pixels can be put on it, which can increase image detail. Depending on the application, half-inch chips are another good option. Many cameras offer digital as well as analog outputs, which means choices from serial component digital to component analog. Many manufacturers offer triax and fiber-optic cable connections as options. Cameras have also become considerably lighter. Also, some cameras allow the camera head to be fully remote controlled from a base station by telephone line or radio unit, which increases flexibility for remotes, particularly sports.

With a fiber-optic cable, runs up to 12 miles without signal deterioration are possible.

Other features include dual motor-driven filter wheels and full auto-setup and diagnostics on camera functions. The filter wheels are in addition to electronic color temperature compensation or white and black balancing, thus allowing for some interesting in-the-camera color effects. Particular colors or neutral density filters can be added during shooting to create or enhance the feelings in a scene without waiting for post-production.

Many of the studio cameras offer storage systems for camera setups. One type of solid-state memory storage card holds up to 20 setups. The change in setup is instantaneous. This means at the touch of a button the camera can be re-balanced for different studio lighting or a completely different show. Another card storage system only holds one setup per card but the card can be used in more than one camera. This ensures a good, if not perfect, match if the same card is used to set up more than one camera.


The HK-377 from Ikegami, which features a horizontal resolution of 900 TV lines.

Several cameras offer long cable run compensators. For example, when using 14.5mm triax, cable runs of up to 8,000 feet can be accommodated. With a fiber-optic cable, runs up to 12 miles without signal deterioration are possible.

Continued on page 50

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THOMSON BROADCAST would like to thank the National Academy of Television Arts and Sciences for once again recognizing the experience and savoir-faire of the mother of digital with an Emmy Award. In 1993, THOMSON BROADCAST's continual efforts to promote serial digital

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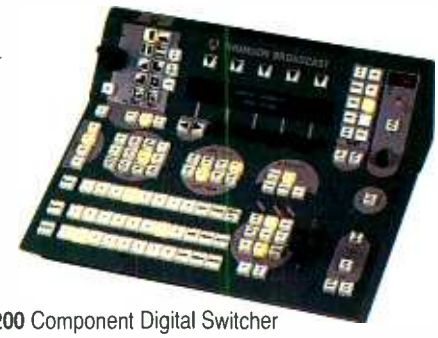

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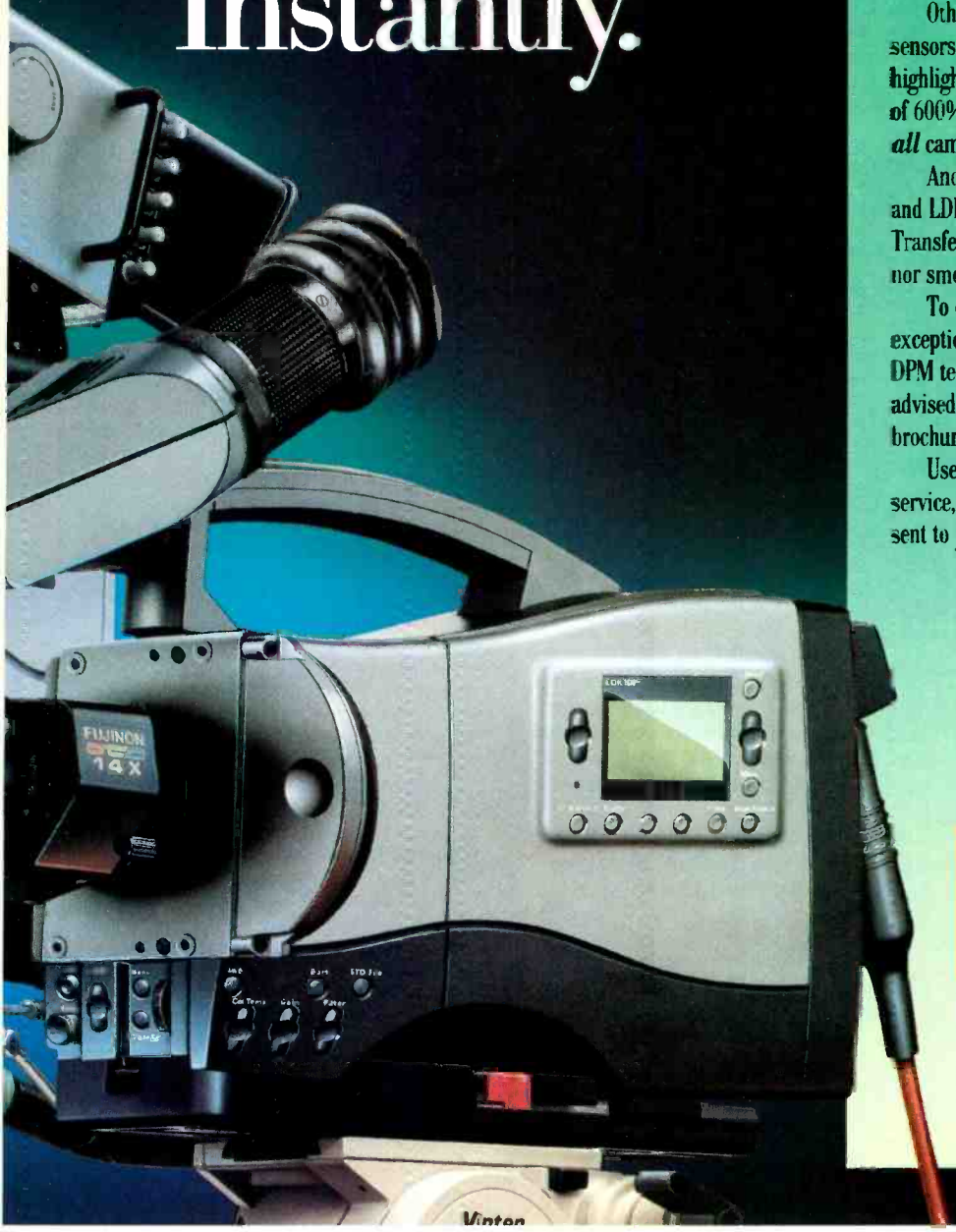

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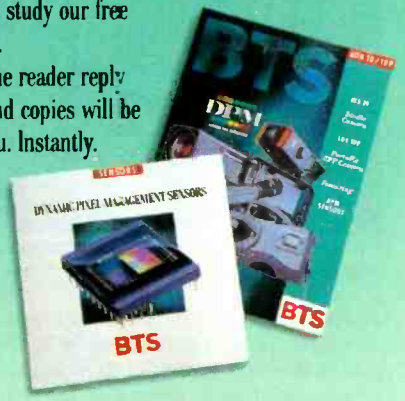

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Creative Television Technology from BTS

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Continued from page 46

Borrowing something from consumer cameras, many manufacturers offer variable speed shutters. Speeds vary from $^1/_{60}$th of a second to $^1/_{2,000}$th of a second. This allows the operator to shoot video from a computer monitor without flicker or phasing bars. A high-speed shutter also allows the shooting of action shots without blurred images.

Future needs

In preparing for the future, cameras are now switchable from a 4:3 aspect ratio to the new 16:9 format. Because of this, these cameras should not become obsolete in the near future. There is still some debate as to how the change in size should be accomplished. At the present time, the sides of the 16:9 image are cut off to produce a 4:3 image. There are those who would rather see a letter box-type image in 4:3 with black at the top and bottom. In this way none of the image would be lost from the sides. However, the viewer would be seeing an image in a form they may not be used to. In conjunction with this switchable aspect output there is also a new possibility in changing the scanning output available from the camera. One manufacturer is offering a camera with progressive and interlace scan output. (See "Cameras with Progressive and Interlace Scan," at right.)

The JVC KY-27, set up in a studio configuration. Many facilities are opting to use EFP-style cameras for studio use.

In the midst of all this, just in case you're still not sure, an aspect ratio converter has been developed. Cameras switched between 4:3 and 16:9 aspect ratios still can only output one format at a time. This device, when hooked to a 16:9 camera output can output both formats simultaneously. It accepts component analog 16:9 and outputs serial component digital 16:9, serial component digital 4:3 and analog component 4:3. Simultaneous outputs allow all formats to be recorded at the same time. The 4:3 recording can be used today and the 16:9 recording archived for a later date. The additional recordings can be accomplished without having to reshoot a scene just to accommodate the other formats.

Scene-to-scene color correction can be done in the camera before shooting.

Summary

Several of the cameras allow for full remote control of all camera functions. This includes the usual production operations, such as white and black levels, and remote control of all the setup functions and correction circuits. In the area of set up, most cameras now offer excellent control of picture details; automatic flesh tone adjustment, 6-vector color correction, automatic shading correction and best of all, setup memory storage. Storage of setup parameters allows the immediate recall of either exactly the same setup used earlier or whatever was decided upon in advance. Scene-to-scene color correction can be done in the camera before shooting.

Today, many of the studio cameras have $^2/_3$-inch CCDs, with from 400,000 to 600,000 pixels. Bandwidth over triax is between 10MHz and 12MHz for each of the RGB channels. Resolution can be upward of 900 lines. Autosetups and diagnostics are almost universal.

With all of these features available, the only thing that remains to be seen is what will be added next year. ■

➡ *For more information on studio cameras, circle the following numbers on Reply Card:*

BTS (328)
Hitachi (329)
Ikegami (330)
JVC (331)
Panasonic (332)
Sony (333)
Thomson Broadcast (334)

Cameras with progressive and interlace scan

The standard output from a video camera, whether it is analog or digital, is the successive lines from one field followed by the successive lines from the next. Each field is composed of every other line of the frame, first the odd lines followed by the even lines. The result is two fields that interlace to produce one frame. Each field is half the picture. In tube cameras the target is scanned by the beam in this manner, and becomes the output. In a chip or CCD camera the information is read out from the sights or pixels on the chip. Progressive scan systems, on the other hand, output the entire image, generally scanning it from top to bottom. Each frame is output complete, rather than as two separate fields.

Because of persistence of vision, images shown at a rate greater than 30 times a second appear as continuous motion. However, depending on the number of images per second, they may exhibit some flicker. Consequently, in a TV scanning system, breaking the image up into two parts (fields) reduces flicker problems as well as accommodates transmission and spectrum space requirements. Picture quality suffers, however. The number of horizontal lines is not that high in current analog systems and showing half the picture at a time does not help matters.

Among other reasons, HDTV was created to address the low-resolution (number of horizontal lines) aspect of current TV standards. The need still exists for greater than 30 images a second, and digital technology allows the 60 fields or images each second to be full images rather than half. In that case, cameras would output 60 frames per second rather than fields, providing 60 full images a second rather than 30.

One way to create a *progressive and interlace* scanning system in a CCD camera is to store the image information in two field buffers. Each buffer holds one field. When used in the interlace mode, the image data is read from each buffer alternately, producing interlaced fields. In the progressive scan mode, single lines from each buffer alternate to the output creating a full frame. Thus, instead of one image split into two parts as in the field interlace mode, there is a full image each time or a total of 60 frames each second. The end result is a doubling of the number of frames and an increase in the resolving capability of the camera. It becomes obvious the image quality would be enhanced. Add to this high-definition scanning with its increased line output and the results should be the best images a TV system has to offer. ❑

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Audio/video routing systems

Handling audio and video in digital and analog forms is a challenge to today's routers.

By Curtis Chan

The Bottom Line

Performance, reliability and flexibility are critical to any switching topology. Successful systems provide all three at a reasonable cost. These challenges are solved in various ways by the current crop of audio/video routers. Today's best systems offer their users flexible architecture, configurable intelligent control and the ability to handle digital and wideband analog signals of numerous formats.

With the variety of analog and digital signals used in today's multiformat production environment, a signal routing system must be extremely versatile and able to accommodate changes in the facility it supports.

The three key functions of today's routing systems are:

1. An ability to handle I/O assignments.
2. The ability to perform *virtual mapping.*
3. Flexibility to handle multiple formats.

The following describes how these operations are handled by current routers.

Router functions

• *Input and output assignment:* Present-day routers allow free assignment of inputs and outputs so that sources and destinations on different levels can be grouped under a single source or destination name. Multiple crosspoints can also be switched simultaneously with a single keystroke and saved in memory. With this feature, the complete system can be updated with a few keystrokes.

• *Virtual mapping:* One of the unique attributes of routers is virtual mapping, of which there are two types. In the first, a single routing matrix can be mapped to operate as a number of separate routers. For instance, a single 32x32 matrix can be divided into a 20x20 and a 12x12 router or two 16x16 routers. The second type of mapping allows multiple routers or matrices to be mapped into a larger, virtual routing level. This is useful in tie-line management of routers when selecting signals across two or three routing switchers. By selecting the source and destination points, the control system automatically establishes the desired routing path, and an auto-protect function prevents the selected path from interruption.

One of the unique attributes of routers is virtual mapping.

• *Multiformat operation:* Today's routers can operate in a multiformat environment, which eliminates the need to provide separate routing systems for different signals. Intelligence in the router also protects the source and destination paths so that each is fed the correct format signal. Most wideband analog routers have bandwidths of 30MHz, but RGB routers have typical bandwidths of 250MHz. With the advent of digital video and the integration of low-cost chip sets for serialization and deserialization, digital composite and component video can be supported. Data rates are 143Mb/s for composite NTSC, 177Mb/s for composite PAL, 270Mb/s for digital component and 360-400Mb/s for 16x9 (at 18MHz) digital component.

Routing system architecture

Routing features vary depending upon the cost and complexity of the system. To meet the basic requirements of today's production environment, however, four router matrix types are available: analog/

Chan is president of Chan and Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA. Respond via the *BE* FAXback line at 913-967-1905.

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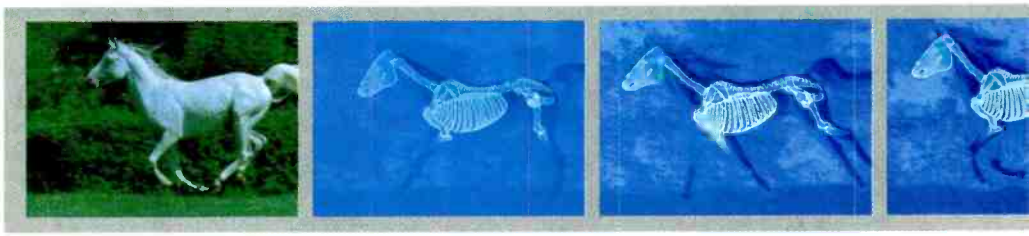

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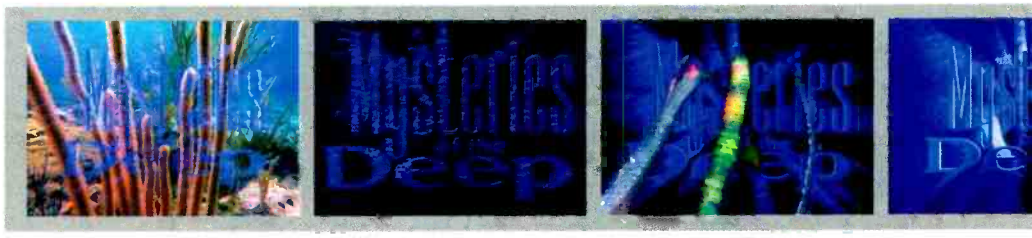

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digital video, digital audio, data (RS-422A, RS-232 or GPI) and time code.

The number of matrices and the maximum size of the router depend mainly on the matrix type. Control typically comes from a PC or dedicated control panel. In addition, crosspoint switching and assignment can be controlled from either distributed intelligent remote-control units or from a master management system. Source and destination displays are either displayed on the control unit(s) via an LCD, LED, fluorescent or video display.

Typical routing system components are described below. In most cases, RS-232 is used for communication between the terminals and ethernet is used between routers and control units. (See Figure 1.)

• *Main routing array:* The heart of any routing system is the router matrix. Each router frame is equipped with a full facility controller card that can control the router as a stand-alone switcher or as part of a larger multilevel router. In most cases, frames can be connected via a proprietary protocol or IEEE 802.3 on ethernet to allow larger matrices or multilevel systems to be built up. To maintain high reliability, most controllers have full redundancy.

The main switcher frame can support multiple standards via plug-in modules. In most cases, partitioning the frame with different modules results in a shared multiformat architecture on the same chassis. The basic switcher begins with a rear-mounted I/O connector panel and cabling. Next comes some sort of matrix card like a 16x32 and a pair of output buffer cards for each *n* output (e.g., *n* = 32). These building blocks are combined to develop the desired matrix configurations. Today's largest and most advanced routers can be flexibly configured by combining small (e.g., 16x16) arrays into large matrices of 1,024x1,024 or even larger. Intelligent hardware/software control interfaces can accommodate up to 32 levels of control.

Signal processing is crucial to signal integrity in these systems, and many companies now use dedicated chip sets for this purpose. For instance, one manufacturer's modular approach includes five chips: crosspoint, serializer, deserializer, regenerator and equalizer. This eliminates unnecessary signal processing, equalization and jitter while also reducing power consumption, heat, size and cost. In addition, reclocking takes place only at the point of entry and exit from the router, resulting in a cleaner, jitter-free signal.

• *General-purpose resource unit (GPRU):* Although not always necessary, a GPRU can house a variety of interfaces for easier access. Interfaces might include video status reporting, cue and tally routing, multiplexed control interface and GPI I/O. The front panel of the GPRU can be fully customizable and fitted with specific switches, displays and key panels.

Today's routers can operate in a multiformat environment.

• *Master and remote-control panels:* Control panels can be simple push-button, X-Y programmable or complex multibus alphanumeric programmable units. On the simple end, push-button strips with each button dedicated to a source/destination can be used with a standard router. Moving up, X-Y programmable panels with either push-button or alphanumeric entry provide breakaway capability and positive feedback. These allow breakaway sequences to be built for single-button takes, and they can use any combination of control levels. Warning prompts are usually given to indicate selection of inhibited, non-existing or protected sources. On the high-end, multibus control panels can control multiple switcher blocks with single keypad entry, and their status will appear on alphanumeric displays. These types also offer memory registers to store frequently used combinations. Most multibus panels can select any source with up to four levels of breakaway, and send it to as many as eight destinations, with the press of a single key.

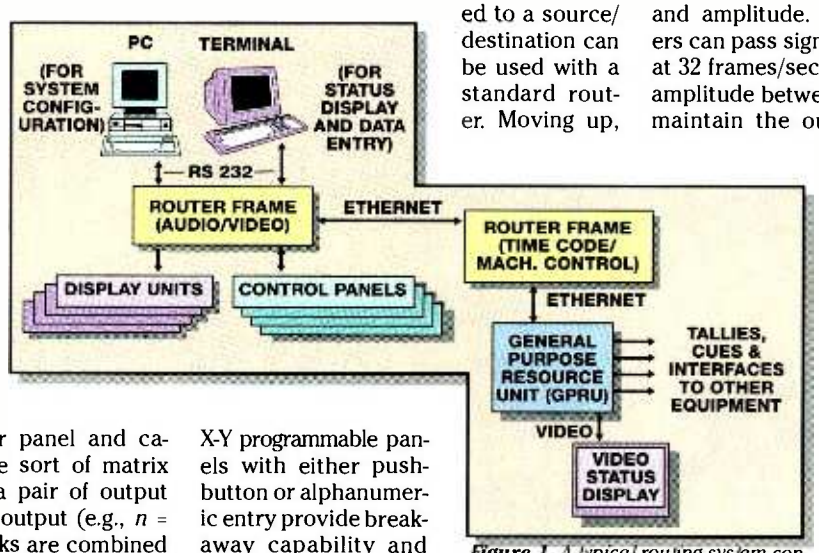

Figure 1. A typical routing system configuration.

• *Monitor display and/or PC control center:* The monitor display usually involves a dumb terminal that displays the status of events and allows simple data entry, such as changing of source names and log events. The control center can be a PC using a graphical user interface (GUI) for system configuration and control panel programming. The GUI display can also allow off-line storage, editing and recall of all configurations.

Routing time code and machine control

Despite the best efforts of ANSI/SMPTE time-code standard 12M-1986, inconsistencies of implementation abound, which complicate the proper routing of time code around a facility. Today's professional equipment uses either balanced or unbalanced and twisted pair or BNC for time code I/O. On top of that, neither the amplitude nor slew rate is controlled, and the problems usually get worse as tape speed increases in ATRs and VTRs.

The easiest solution uses a time-code router, which processes the input time code as a digital signal, routes it as asynchronous bi-phase data, then reprocesses the signal to ensure correct rise times and amplitude. Typical time-code routers can pass signals from $^1/_{30}$ to 100x play at 32 frames/sec, keep a constant output amplitude between +1.9dBu/+2.6dBu and maintain the output rise-time proportional to the play speed.

Routing RS-422A machine control signals can also be problematic. On a bad day, mapping RS-422A through a router is like facing midtown Manhattan during rush hour — every other street is one-way and sometimes it is better just to sit it out. Because commands are transmitted on one balanced pair and received on another, the system's crosspoint count, wiring density and complexity are inherently double that of a simple program router.

To further complicate matters, internal circuitry within the machine reassigns the interface pin assignments to allow it to operate in either controlled or controlling mode. Whether the switch is physical or under software control, traditional routing can't adapt to a reversal of data direction. Finally, when sending a command down a daisy chain of slaved devices, it is difficult to discern which of the slaved devices is responding or having a bus-contention problem.

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Traditionally, relay or analog audio routers were used to switch machine control data, which became an expensive proposition. Newer routers can fully address RS-422A switching with NRZI data rates up to 5Mb/s, however, and they have the ability to dynamically configure each I/O port to one of three states: controlling, controlled or high-impedance. Executed automatically with each take command, this transparent changeover action in the router emulates the mode-swapping capability of the external machines and simplifies system configuration.

Hints on routing system design

For the most part, handling video signals is relatively straightforward. The trouble usually starts when you have to mix analog and digital audio along with the video. The following are some hints that might make your job easier in designing your routing system for a audio/video digital facility.

• *Consider fully digital audio switching:* Direct digital transfers across dissimilar format machines will eliminate unnecessary conversions, save equipment costs and configuration time. The overall cost is small compared to the benefits, even if asynchronous routing is used.

Today's most advanced routers can be flexibly configured into large matrices up to 1,024x1,024.

• *Plan your routing options:* Use synchronous digital routing for on-air situations or frame-accurate editing. Use asynchronous routing for pegged circuits (i.e., where routing remains fixed throughout a session), and for mixed sample-rate audio production. A small asynchronous router as a preselector to a synchronous router will allow sharing of resources to process wild inputs.

• *Synchronize and standardize your facility:* For synchronous routing, lock all audio and video to a common reference. Also, sample-rate convert wild inputs to the facility master time base. It might make sense to convert all analog signals to digital early in the path (i.e., ahead of the router) to keep the quality as high as possible before converting back to analog. As is the case for video, define an in-house full-scale digital audio reference level and stick to it.

Arming yourself with today's technology, a few house standards and some basic knowledge will allow you to navigate smoothly through the increasingly complex labyrinth of audio/video signal routing and distribution. There is no more important element in the infrastructure of a broadcast or production facility.

Editor's note: The author wishes to thank Birney Dayton and Charles Meyer at NVision for their assistance in preparing this article. ■

➡ *For more information on audio/video routers, circle (335) on Reply Card. See also "Routing Switchers," p. 56 of the 1994 BE Buyers Guide.*

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World Cup Soccer '94

The quadrennial spectacle will feature many firsts this time, particularly for U.S. audiences.

By Gerald M. Walker

The Bottom Line

It's being called the biggest broadcast show on Earth — the 1994 World Cup Football Championships, which begin this month with the United States as host for the first time. Even with the infinitesimal U.S. audience for "soccer" (as they call it), the Cup has had enormous impact: Stadiums have been altered, real grass has replaced artificial turf (even inside the Pontiac Silverdome), and a massive communications network has been installed. The broadcasts will also be unusually free from commercial interruption. Overall, the games are estimated to have a $4 billion economic impact on the United States.

The most bizarre aspect of the 1994 World Cup is that the host country is not the host broadcaster. The rights as host broadcaster went to *EBU Sports International* (ESI), a U.S. corporation formed by the European Broadcasting Union. ESI has established its offices in Atlanta, and created the International Broadcast Center (IBC) in Dallas, using a combination of experienced World Cup broadcasters from the EBU and American staffers familiar with the high-tech style of U.S. sports broadcasting.

As host broadcaster, ESI is charged with originating and transmitting the *World Feed* for all 52 matches. Feeds will be in classic international style — non-biased with standard soccer graphics and replays and no unilateral elements, such as on-camera appearances of the commentators.

ESI will also provide facilities and services at the IBC and the nine competition venues for nearly 100 rights-holding radio and TV broadcasters from other countries. This includes studios and production facilities for the broadcasters' unilateral coverage, along with scheduling of satellite time and other interconnection services. ESI will also provide broadcasters with statistical information about the 24 participating teams, the venues and the game in general.

Setting up the IBC

All video in and out of the IBC will be in NTSC format. This includes NTSC satellite delivery, so conversion will be done by foreign rights-holders upon receipt, if necessary. The bulk of the IBC's equipment is rented, so use of easily available hardware was essential. In keeping with its conservative philosophy, the IBC video format is Beta SP.

Conservative or not, the ESI procurement is big. More than 1,000 people will be employed at ESI during the Cup. There will be nine production trucks, 120 cameras, 250 VTRs, 5,000 videocassette tapes, 1,100 commentary positions, 1,800 audio commentary circuits, more than a dozen satellites, and almost 40,000 miles of fiber-optic cable in use.

Backhaul challenges

World Cup '94 has already been labeled the largest satellite broadcast effort in history. Surprisingly, the biggest challenge to the production was choosing and organizing a workable system within the American climate of regulatory freedom, which allows so many communications providers to coexist.

Nevertheless, ESI has harnessed this abundance to serve up the Cup to a cumulative world audience estimated to be 32 billion by the time the Final rolls around on July 17 in Los Angeles. An expected two billion will watch that game alone. All of the international feeds will be live — no tape delays will be provided by ESI — so most of these 32 billion viewers will be ignoring time zones to view the action. This also implies that there is no room for failure.

After the first round, satellite links will be especially challenging. This is because it will be impossible to plan which countries' teams will play in later rounds and how much demand there will be for pre- and post-game feeds. ESI will have a single day to make connections and routes that it had three months to prepare for in the first round. To deal with this, ESI has "warehoused" satellite capacity to use as

Walker is editor-in-chief of *World Broadcast News*. Respond via the *BE* FAXback line at 913-967-1905.

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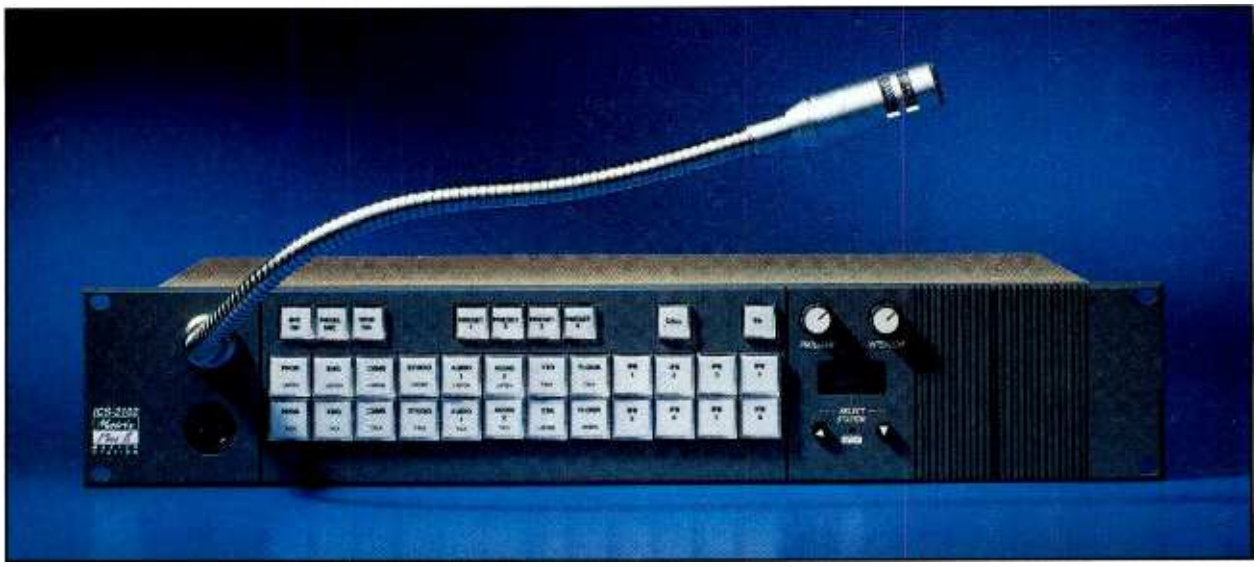

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needed through the later rounds. Adding in the regional birds used for transmission in other parts of the world, as many as 30 satellites could be involved during the World Cup.

ABC/ESPN do it the American way

ABC Sports and ESPN cable network are the joint U.S. rights-holders for the World Cup matches. ABC will cover 11 matches, including the final championship game. ESPN will cover the other 41 matches, so all 52 games will be televised in the United States. Both broadcasters will combine the World Feed with augmentation from their unilateral cameras, plus their own commentators.

The biggest accommodation that American broadcasters have made for the Cup coverage is the decision to forego commercial interruptions during play. Commercials will be aired during the pregame, half-time and post-game segments only. Major sponsors' logos will be superimposed on the on-screen "game clock" during play. (There is no real stadium game clock in soccer. The official clock is the responsibility of the officials on field, who have discretionary power over the time.)

The Rose Bowl in Pasadena, CA, is the site of the 1994 World Cup Final. Other matches will be held in New York, San Francisco, Washington, DC, Boston, Chicago, Detroit, Orlando and Dallas.

Because ABC Sports has been covering NFL or college football at most of the stadiums involved in the World Cup, they have no need for a unilateral facility at the Dallas IBC. The network will tap into the IBC's information pool to support its own commentators, however. ABC will employ the same trucks and backhaul links that it uses to cover NFL Football.

For ESPN, no sweat

ESPN will embellish its coverage with remote-control cameras behind the goals and a unilateral Super Slo-Mo system for some games. (Security requirements limit what ESPN and ABC can do with on-field ENG cameras, hence the reliance on remote-controlled cameras.) ESPN will also provide reverse angle coverage, and its commentators will have on-screen drawing capability. Like ABC, ESPN will use its usual domestic satellite backhaul links.

The result of all this will be the first time an entire World Cup has been available in English on U.S. television. It also will be presented in a distinctly American TV style — except for the commercials. ■

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The HK-377 Ultra-wideband Studio/Field CCD Camera System has the highest resolution, sensitivity and pixel count of any NTSC camera currently available. The camera employs newly-developed 2/3" FIT CCDs, each with more than 600,000 pixels. An ultra-wideband triax system with 10MHz bandwidth for each RGB channel delivers an unprecedented 900 TV Lines resolution at the base station output. The new base station has provisions for digital signal output (optional) to accommodate the demands of high-quality production.

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Current users include: ABC (*20/20, World News Tonight, Good Morning America, All My Children, Loving, Prime Time Live, etc.*), CBS (*Late Show with David Letterman, 60 Minutes , CBS Evening News, Sunday Morning, etc.*), Disney/MGM, MTI, TNN, Turner Entertainment Network, Goodyear Blimp, Unitel Mobile Video, GC & Co., and Channels 2 and 13 Buenos Aires.

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Wrist-watch profits

Dick Tracy move over — the MessageWatch is here, and broadcasters get a piece of the action.

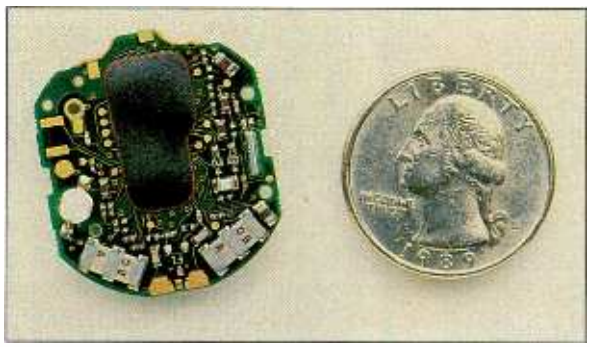
By John C. Kean

The Bottom Line

FM subcarrier applications are about to get a boost as the long-awaited wrist-watch pager debuts. Buoyed by the name recognition of a popular watch manufacturer, this service could become the most successful subcarrier service ever launched. It provides subcarrier-leasing opportunities for multiple FM stations in every market as the system builds its planned worldwide coverage.

$

From a broadcast engineer's perspective, leasing subcarrier capacity is like renting out a guest room in your home. The additional revenues it provides must be balanced against the overall cost of management and oversight of one or more subcarrier lessees. The *Advanced Communications and Time-keeping Technology* (ACTT™) system from Seiko Telecommunication Systems (STS) of Beaverton, OR, is a subcarrier lessee who, like a good housemate, strives to be neat, quiet, relatively undemanding of physical space and financially stable.



The MessageWatch circuit board.

Now installed at 13 FM stations in Portland, OR, and Seattle (areas well-known for their challenging terrain conditions), the ACTT system is used to broadcast paging and other data to approximately 12,000 *MessageWatch* wearers in those markets. The MessageWatch combines a Seiko electronic timepiece with a versatile pager in a men's-sized wrist watch.

Kean is *BE*'s consultant on subcarrier technology, and a consulting engineer at Moffet, Larson & Johnson, Falls Church, VA. Respond via the *BE* FAXback line at 913-967-1905.

STS plans to expand its network of radio stations to cover all major metropolitan areas in the United States by 1995. It is also planning to establish ACTT networks in a number of countries including Canada, China, France, Japan and the Netherlands, with the goal of becoming the first global subcarrier network.

The ACTT subcarrier communications protocol is called the *High-Speed Data System* (HSDS). It is based on a packet-oriented, time-division multiplexed (TDM) scheme with a raw data rate of 19kb/s. The HSDS FM-subcarrier channel is centered at 66.5kHz, to be compatible with international subcarrier spectrum standards of 53kHz to 75kHz and the (stereo-compatible) U.S. standard of 53kHz to 99kHz. The center frequency is 3.5 times the 19kHz stereo pilot, which allows phase-locking to the pilot for ease of receiver implementation. The subcarrier is summed onto the FM station's baseband signal with a typical injection of 10% (7.5kHz deviation).

ACTT keeps to itself

In FM subcarrier applications it is critical that the subcarrier not interfere with the main audio channel in a way that would affect perceived audio quality. There are two principal considerations in this regard. The first relates to the transmission filter and out-of-band attenuation. HSDS filtering at the transmitter is implemented digitally with a finite impulse response (FIR) filter. The subcarri-

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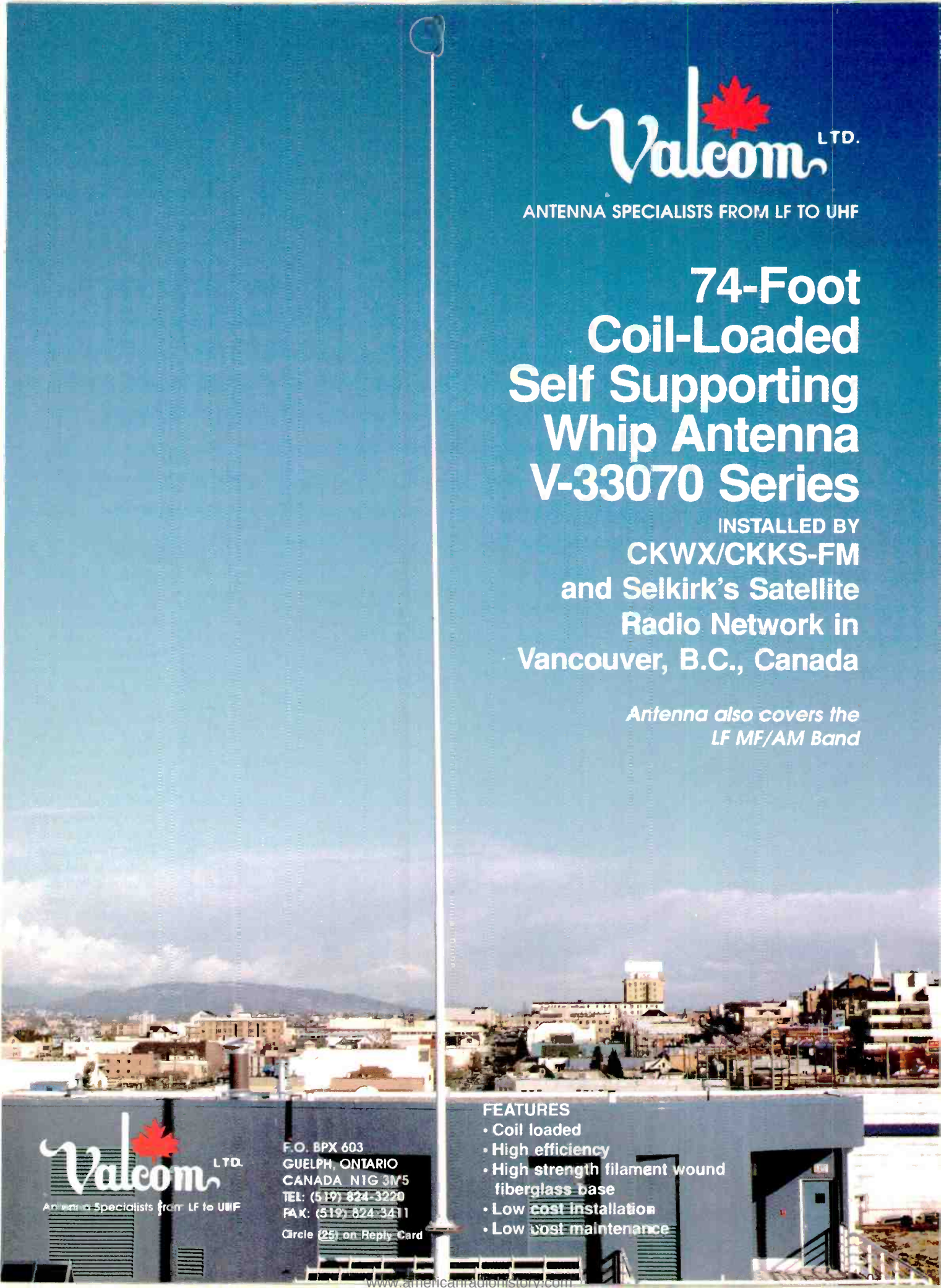

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The ACTT system broadcasts data to approximately 12,000 MessageWatch wearers in Portland and Seattle.

er energy is attenuated more than 60dB at the channel edges.

Figure 1 shows a spectrogram of an actual FM station operating with processed stereo audio and an HSDS subcarrier. The 19kHz stereo pilot is plainly visible at a level approximately 20dB below reference modulation (±75kHz peak deviation). The 38kHz L-R subchannel energy extends from approximately 23kHz to 53kHz. The HSDS subcarrier centered at 66.5kHz in Figure 1 shows the steep attenuation slopes provided by digital filtering. (Due to the integration time of the filters in the spectrum analyzer, the indicated level of the modulated subcarriers is less than their steady-state values.)

The HSDS spectrum has been shown to be compatible with RBDS service, which operates at 57kHz. After thorough testing of RBDS receivers, STS has determined that the HSDS modulation spectrum degrades RBDS by an average of less than 1dB, based on the typical RBDS bit error rate (BER) performance of 10^{-2} and the recommended (minimum) RBDS injection level of 2.66%.

Regarding spectral space requirements, as implied earlier, the ACTT subcarrier is friendly to existing stereo main channel audio, RBDS and 92kHz subcarrier services. Only existing 67kHz subcarrier services would have to be removed to accommodate ACTT transmission.

The second potential interference source is non-linear mixing of the subcarrier and the main-channel audio caused by multipath. As a countermeasure, the HSDS protocol uses data-randomization to "whiten" the signal, thereby avoiding generation of perceptible beat notes (birdies). Extensive testing and operational experience in Seattle and Portland have demonstrated HSDS has no noticeable interference with the main channel audio. To demonstrate this performance, recordings of mobile stereo FM reception have been presented by STS at various local SBE meetings.

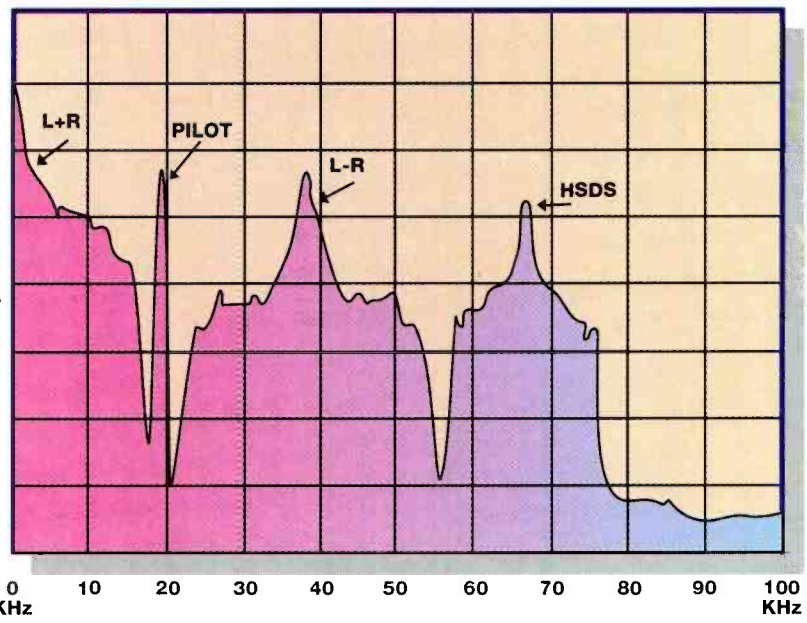

Figure 1. *Baseband spectrum display of actual stereo-FM station running 66.5kHz HSDS subcarrier.*

High data-transmission rate

The ACTT system currently operates one of the world's highest data transmission rates for paging-style *personal communications services* (PCS) devices. The 66.5kHz subcarrier is a double-sideband, suppressed-carrier, PSK amplitude-modulated signal using a technique of controlled intersymbol interference called *duobinary encoding* to achieve 1bit/s/Hz efficiency. At 19kb/s, HSDS is 16 times faster than the current RBDS standard and eight times faster than the new 2,400bit/s paging code standard. This means radio stations in a market may be able to serve millions of subscribers.

The MessageWatch combines an electronic timepiece with a versatile pager in a men's-sized wrist watch.

HSDS allows the use of extremely small receivers with extremely long battery life. Receivers may have duty cycles that range from continuously on to as low as 0.01%, providing flexibility to optimize message delay, data throughput and battery life.

Unique to the HSDS protocol is its ability to use multiple-station transmissions and retransmissions of paging and other data. This ensures high reliability, especially in multipath situations where signal "collisions" can cause loss of data. The use of multiple FM stations for transmission within a single market is accommodated by the ACTT system's use of frequency-agile receivers, precise time-offset message transmission on each station, and transmitted lists. By transmitting the same message from one or more stations, using short time delays (offsets) between transmissions, the HSDS protocol affords ample time for a patented, frequency-agile antenna in the ACTT receiver module to change its tuned FM frequency to a clear signal containing a message packet. (The antenna also adapts to whether the watch is being worn, and even to the wrist diameter of the wearer.)

The multiple-station capability of the HSDS protocol not only ensures high message reliability, but also allows FM stations to be easily networked together into a single system. It achieves this through the following technique.

Along with formatting, address, Universal Coordinated Time (UTC) and message data, each HSDS protocol data packet contains a list of surrounding FM stations using the protocol. By reading this list and then automatically adjusting its subcarrier receiver to an available signal, an ACTT receiver module can operate continuously as it moves out of one FM station's broadcast area and into another's. With this ubiquitous coverage capability, STS plans to cover the United States, and eventually the world, with a unified global ACTT network.

It also means that many FM stations may have an opportunity to share in STS's success by providing the system's delivery channels on their subcarriers. ■

➡ *For more information on the Seiko Telecommunication Systems ACTT system, circle (318) on Reply Card.*

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Radio in transition

Implementing RBDS

Getting RBDS on the air sooner rather than later has its advantages.

By Skip Pizzi, technical editor

The Bottom Line

The Radio Broadcast Data System (RBDS) has been an official U.S. standard for about a year, and the industry is slowly beginning to implement it. The classic "chicken and egg" problem has kept it from rapid success, with most receiver manufacturers waiting for the number of RBDS stations and the consumer demand for RBDS radios to increase. Broadcasters needn't wait to reap the benefits from RBDS, however. New "industrial" applications can allow the service to turn some quick profits.

$

FM radio stations in the United States have gradually begun to implement RBDS. The 57kHz subcarrier service has a lot of features to offer (see "Rx for New Radio Profits," March 1992), but its ultimate consumer acceptance in this country is still uncertain. A critical mass of stations has not yet begun to offer RBDS (although the number is slowly growing). Also, the quantity of receivers on the U.S. market capable of displaying RBDS data is still tiny. With only a few notable exceptions, major receiver manufacturers — including the important car radio makers — have maintained a wait-and-see attitude about RBDS.

Major receiver manufacturers have maintained a wait-and-see attitude about RBDS.

Nevertheless, RBDS encoding hardware is relatively inexpensive and easy to install. (See "Re: Radio," May 1992.) The starting point is an RBDS coder, which is a programmable data modulator and 57kHz subcarrier generator in a single box. RBDS data is generated either by the coder's internal processor or by an external PC connected to the coder via RS-232 (or both). Incoming data via telco line from a third-party client can also be incorporated. The composite FM signal is sampled by the coder for synchronization of the 57kHz subcarrier and its 1,187.5Hz word clock to the 19kHz pilot. Finally, the RBDS coder output is sent to the stereo generator's subcarrier input, data settings are initialized, and RBDS service is up and running.

Space requirements are typically a few rack units and perhaps some desktop space for a PC (or just a laptop). Coder costs are typically under $5,000, although a station can spend from about $2,500 to $10,000 or more to implement RBDS.

The downside

As the early adopters of RBDS have become more familiar with the system, they have encountered stumbling blocks that are impeding RBDS from reaching its full potential. Consider the following:

• *Is it RDS or RBDS?* The Radio Data System (RDS) was developed in Europe in the 1980s. It is now in relatively widespread use there among state-sponsored/controlled and other public broadcasters. (Private commercial/independent stations in Europe have not yet fully embraced the system.) Subsequently, the U.S. variant of RDS was developed, using the same core technology but with different coding definitions and other details. To distinguish between systems, the U.S. standard is called Radio Broadcast Data System (RBDS). However, receiver manufacturers are generally sticking with the "RDS" terminology in labeling and marketing RBDS-equipped receivers in the United States. Naturally, this has caused some confusion within the industry.

• *Not all RBDS radios are created equal.* For a radio receiver to display the RDS/RBDS logo, not all RBDS functions have to be included. In fact, no current RBDS radio incorporates every possible function of the system, and probably few ever will. The RBDS receiver standard is vol-

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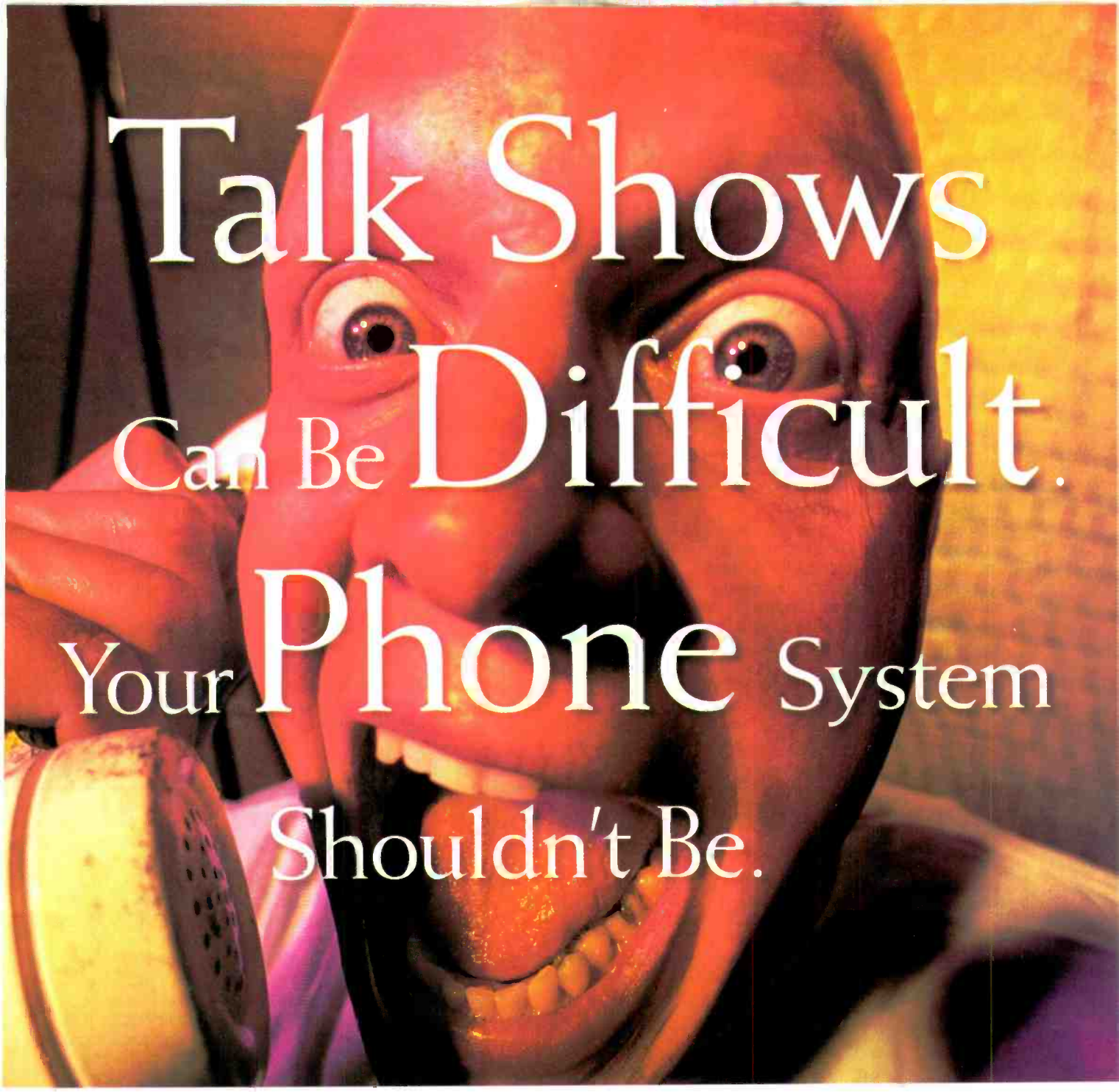

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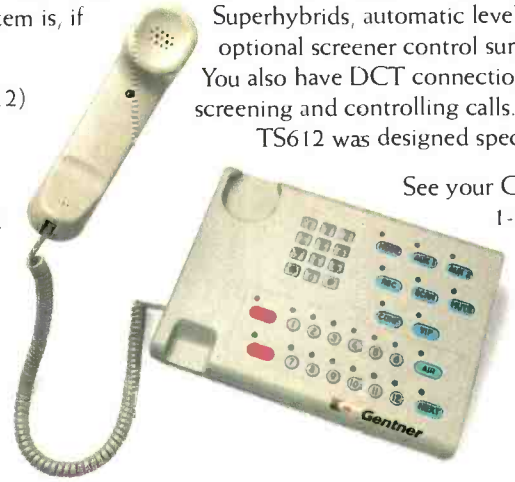

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untary. Receiver manufacturers need only to comply with it to the level that they feel is appropriate to a product and its market. (Some *encoders* are not fully capable of implementing all the RBDS standard's features.)

• *The RBDS data rate is low.* With the advent of several new non-RBDS subcarrier data systems offering data rates up to 19kb/s (see "Wrist-Watch Profits," p. 62), some broadcasters have questioned the wisdom of establishing a subcarrier service with a data rate of only 1.2kb/s.

• *Sufficient consumer demand has not been demonstrated.* RBDS service is unlike anything ever presented to the broadcast consumer. It is unclear if listeners will accept and use the text data and "smart-radio" features delivered by RBDS. Traffic data and emergency alerting functions seem to be the only items that are considered generally desirable to today's average user.

• *Encoding hardware is still largely Eurocentric.* Much of the RBDS equipment available to U.S. broadcasters is European hardware that has been adapted to RBDS operation. This can make it expensive or difficult to use.

The EIA is promoting the cause of RBDS within the consumer electronics industry. This display appeared at the 1993 Summer CES in Chicago, where more than a dozen FM stations were broadcasting RBDS data.

The upside

There is hope on the horizon regarding some of the problems just mentioned. For example, RBDS proponents argue that even at only 1.2kb/s, RBDS can still provide a significant amount of program-associated data (PAD), plus some ability to serve third-party functions for industrial users (i.e., non-listeners), such as paging or Differential GPS. (See "Radio in Transition," December 1993). Meanwhile, most of the new higher-speed subcarrier data services are targeting non-PAD applications. It may be some time before any of these new systems are actually producing revenue for their host stations (if ever). RBDS is already an accepted standard, and hardware is in production. New third-party RBDS applications continue to develop, and a station can support several of these services simultaneously on the so-called Group 3 (and other) data packets of its RBDS service. Furthermore, RBDS does not preclude the use of other higher-frequency, higher data-rate subcarriers by an FM station, using either existing or proposed technologies. Therefore, no avenues to future datacasting growth are closed by implementing RBDS today.

Concerning consumer demand, the EIA has recently begun a survey of consumer preference for RBDS services. Results should be available soon. EIA is also con-

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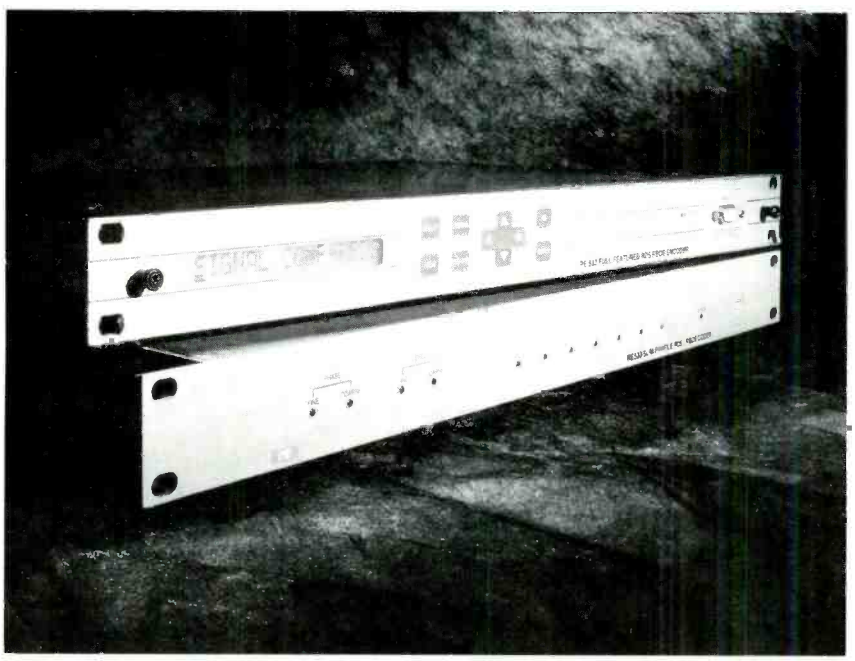

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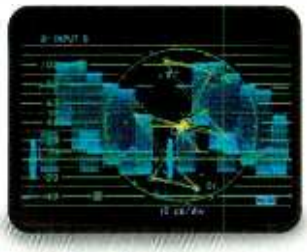

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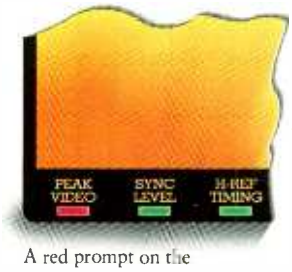

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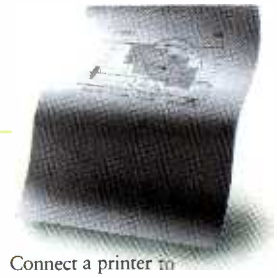

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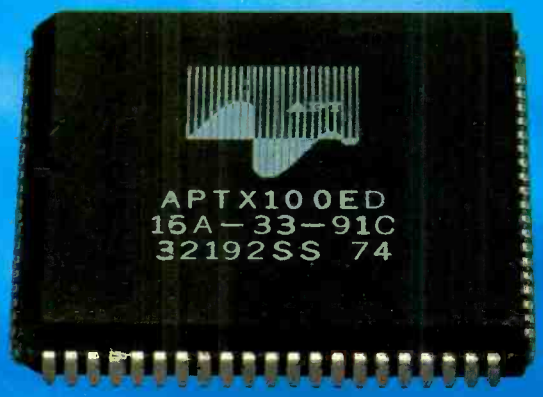

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ducting training and awareness workshops for broadcasters and retailers about the RBDS service.

Meanwhile, second-generation RBDS encoding hardware is now becoming available, which is more appropriate and configurable to current and future U.S. needs.

Monitoring the RBDS signal

As radio stations begin to implement RBDS, it has become necessary to monitor for presence and quality of the subcarrier and its data. Just putting an RBDS radio in your car and checking the display on the ride home is not enough.

Responding to this need, a few manufacturers have released RBDS monitors with many special features. Currently, these monitors are designed either as rack-mounted, dedicated devices or as PC-based, software-driven systems.

One important feature that some of these monitors provide is the ability to measure the actual injection level of the 57kHz RBDS subcarrier. This is critical because at its nominal recommended level of 2.6%, the RBDS subcarrier may fall outside the injection measurement tolerance of some FM modulation monitors. Another useful feature on some RBDS monitors is a tunable front end, allowing a station to closely monitor its competitors' RBDS signals.

Short-term vs. long-term benefits

Although only about 2% of U.S. FM stations have implemented RBDS, there may be considerable advantages (and minimal risk) for stations adding the service today. Short-term payback to broadcasters on their RBDS implementation may come from industrial users of third-party applications, while the value-added advantages of PAD and "smart-radio" RBDS features may not be experienced until later.

Industrial RBDS applications and hardware may soon experience significant expansion. For example, RBDS paging, which to date has been dominated by one or two companies, may soon have several new players and much wider availability. Other industrial RBDS receivers have also been developed, providing enhancements that make them appropriate for new mobile data applications. These features include addressability, custom configurability, integrated locating ability and full RBDS feature-set decoding.

Because of their easily targeted markets and valuable services, industrial applications may achieve quick viability and profitability. It may benefit stations to be among the first to implement RBDS in their markets, thereby attracting third-party service providers to established 57kHz subcarriers.

Although it will take time before RBDS provides service to large numbers of listeners, it may bring an earlier revenue boon to stations via its other uses. ■

➡ *For more information on RBDS encoding hardware, circle the following numbers on Reply Card:*

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Broadcast Electronics	*(320)*
Circuit Research Labs	*(321)*
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Re: Radio

Back to basics

By John Battison, P.E.

I've been meeting quite a few new entrants to the radio field recently. Despite the industry's current loss of technical positions, it seems that some young men and women *are* going into radio station work. Some radio stations are also offering LPTV as an extra service — a sort of "radio with pictures" — and these will also need technical help.

To my surprise, some of these new AM/FM/LPTV combo stations do not have a steady, or contract, technician or engineer. It is amazing what some station managers will do when establishing an operation. Recently I visited an AM/FM/LPTV operation. For part of its programming, the station simulcast a popular talk-radio show on AM and LPTV. The day that I was there the station had audio problems. Everything was normal on the AM side, but no audio was being broadcast on the LPTV signal. I tried to track down the audio path through a maze of unlabeled cables in master control. I finally discovered that for some unknown reason, the LPTV audio feed for this simulcast came from the AM *air monitor*. No audio signal was present because someone had flipped an output selector switch on the air monitor, cutting off the AM audio feed to LPTV master control.

I asked why they didn't use a hardwired audio line from the AM console to the LPTV switcher, but no one seemed to know why or perhaps how to do it. (Because this was a regular daily program, hard wiring seemed an obvious solution.)

In earlier times, technical and operations personnel had to know the basics and understand how things worked. They had to know what to try if something failed. They also had to know what was inside the black boxes — although the equipment was often *not* in a black box, but rather on a breadboard.

Paths toward competence

The much-maligned First Class Radiotelephone Operator's License was finally laughed out of use by the proliferation of "5-week wonders" who memorized answers and became DJ/engineers on the strength of a dubious certification. Yet, in its earlier days, the "first ticket" had great value. There was a large number of "first phones" who studied engineering while taking transmitter readings every half-hour and became competent engineers. Unfortunately, that number is growing smaller every day.

In earlier times, technical personnel had to know the basics and understand how things worked.

The SBE has attempted to remedy the situation with its broad range of certification by examination. Failure to join SBE or take its exams does not mean that an individual is incompetent. It *is* important, however, when looking for a new job to have some certificate that attests to your abilities. Passing an SBE test generally indicates that a person has reached a specified level of knowledge, and, in some cases, experience.

Fewer do-it-yourselfers

There seems to be an increasing tendency to send pieces of equipment back to manufacturers for service. In many cases, this makes more sense than having some ham-fisted individual with a 100W soldering iron attempting to change a transistor. More seriously, the cost of the test equipment and spare parts stock required to repair modern black boxes often makes it uneconomical, not to mention the time and know-how required at the station.

On the other hand, the enthusiastic engineer wants to know what's in the box and feels honor-bound to repair it. There is a point at which labor costs become untenable, and engineers must recognize this. Returning small units to the manufacturer makes some sense, but large items, such as transmitters or RF/antenna components are usually best serviced at the station.

In another nearly extinct tradition, station personnel built a lot of the station's equipment from scratch. Sometimes this was the result of the exact device's unavailability off-the-shelf, or because of its prohibitive expense. In other cases, long delivery dates or simply the chief engineer's love of construction projects was the reason. I expect that many of these home-brew items cost more than their store-bought equivalents when labor charges were included. Yet the knowledge acquired while designing and constructing the project was an intangible and invaluable element. Few stations allow this today.

Some powerful advice

One of the first important lessons to newcomers is the advice to not believe everything you are told. For example, we tend to assume that because incoming power from the utility is identified as "240V, single-phase, 60Hz," that it truly is just that. If you are having unexplained equipment problems take a look at the quality of your primary power that is delivered from the utility company. Sine waves are not always sine waves. Sometimes they have spikes that can damage equipment and put you off the air. Modern solid-state and computerized equipment can be fussy about pure waveforms.

This can make veteran broadcasters envious of older tube equipment — but then consider who among newer technical personnel could work with it? I know of one recent hire that fell through when the prospective individual said to station management, "Oh, it's a tube transmitter? I don't think I could handle it — never mind." How disappointing. Here was a chance to learn something new, an important motivation that seems to be missing from today's technical personnel in radio. This type of attitude will not help new technical people succeed in the future broadcast environment.

■

Battison, *BE*'s consultant on antennas and radiation, owns John H. Battison and Associates, a consulting engineering company in Loudonville, near Columbus, OH.

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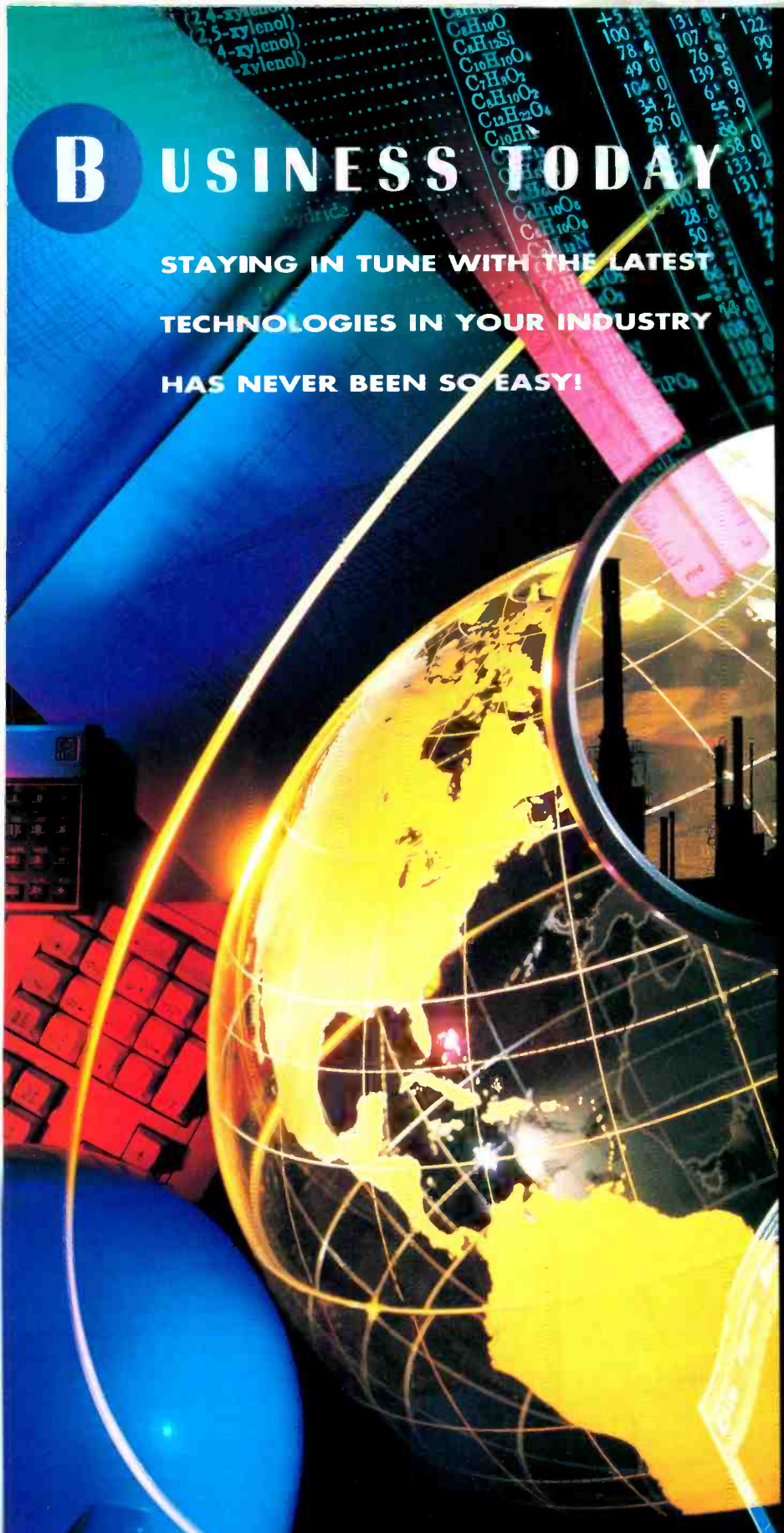

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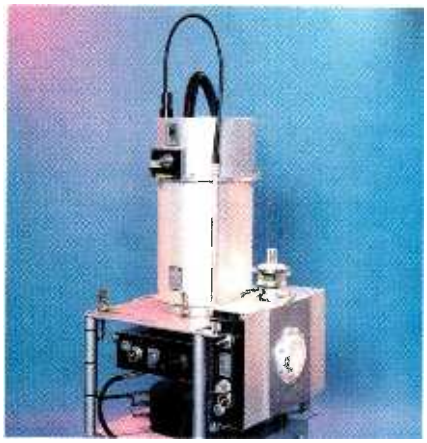
Tubes vs. solid-state devices



By Don Markley

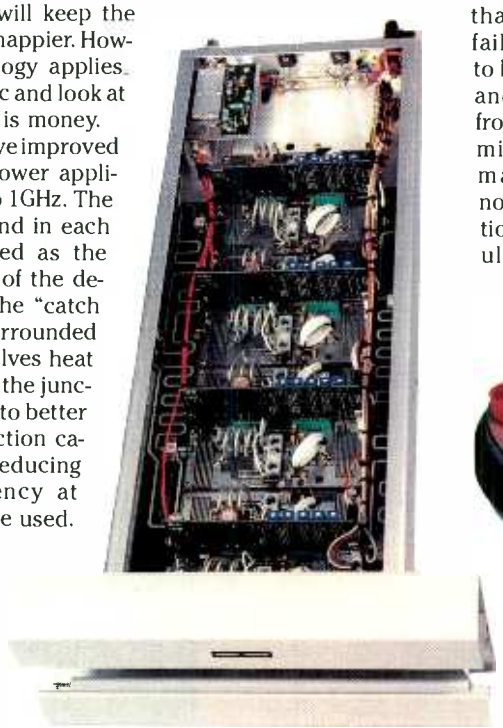
When Einstein was a young man, he briefly worked as a patent examiner. He was good, and was able to cut through the rhetoric of patent applicants and quickly evaluate the basic principles involved in each application.

Although solving the problems involved in selecting a new transmitter will not win you a Nobel prize, it will keep the suits in the front office happier. However, the Einstein analogy applies. Sweep aside the rhetoric and look at the bottom line, which is money.

Solid-state devices have improved significantly for high-power applications from 100MHz to 1GHz. The number of devices found in each amplifier has decreased as the power-handling ability of the devices has increased. The "catch 22" that has always surrounded high-power design involves heat and capacitance. When the junction area is made larger to better dissipate heat, the junction capacitance increases, reducing the maximum frequency at which the device can be used.

For all practical purposes, VHF television has gone totally solid-state. Efficiency has never been the significant item of interest for the big boys who play in that arena. Regardless, the solid-state transmitters for VHF approach tube efficiency and the costs are about the same. The improvement in dependability that accompanied the conversion to solid-state transmitters has been a significant factor as well as stability and the broadband nature of the amplifiers.

Virtually all solid-state transmitters use multiple amplifiers operating in a parallel configuration. These amplifiers normally operate in a "soft-fail" manner, wherein the failure of one amplifier module only reduces the total power output and does not take the transmitter off-the-air. Also, virtually all modern transmitters have hot plug-in capability and diagnostic systems that permit a failed module to be identified and removed from the transmitter while maintaining normal operation. The modules can be repaired and, in some cases, bench tested while the rest of the system plays on. Many manufacturers proclaim their modules to be "field repairable," which is a nice feature if you have the personnel and parts. Of course, Boeing's 747 can be called "field repairable" if you like.



A Harris Platinum series solid-state module used for VHF.

The 60kW TH760 Diacrode, one of the newest IOTs from Thomson Tubes Electronics.

FM transmitters

In smaller applications, such as a small FM station, other criteria may be more significant. Let's compare small FM transmitters with either a solid-state or a tube final amplifier. We'll assume only one tube will be used in the transmitter.

Looking at a Class A FM station, we will assume a transmitter power output (TPO) of 3.8kW is needed. A careful search of the literature finds a solid-state transmitter for $36,500. Being thorough, you also look for a tube-type transmitter. The nearest thing is a 5kW model that lists for $36,300. At first glance it looks like the sensible move is to buy the solid-state system. Just think of the huge increase in reliability.

Wait. Now is the time to do your Einstein imitation and look at the basics. While the mean time between failure (MTBF) of solid-state devices is normally higher than for a tube, it is not infinite. In addition, the solid-state transmitter has replaced one vacuum device with several solid-state devices. Therefore, the MTBF of the overall amplifier has been reduced by 1/n, where n is the number of devices. It really isn't that simple. Many other things are involved like high-voltage supplies, tube sockets, etc. In any case, it is not unreasonable to assume a module may fail once every two years (rough approximation).

When an RF amplifier module fails, you are back to the field-repairable 747 syndrome. The typical technician is experienced in audio and is not ready for one of these modules. Therefore, the module ends up going back to the factory for repairs. For this system, the module exchange price is approximately $1,100. A new spare is about $2,300. On the other

Markley is president of D.L. Markley and Associates Inc., Peoria, IL.

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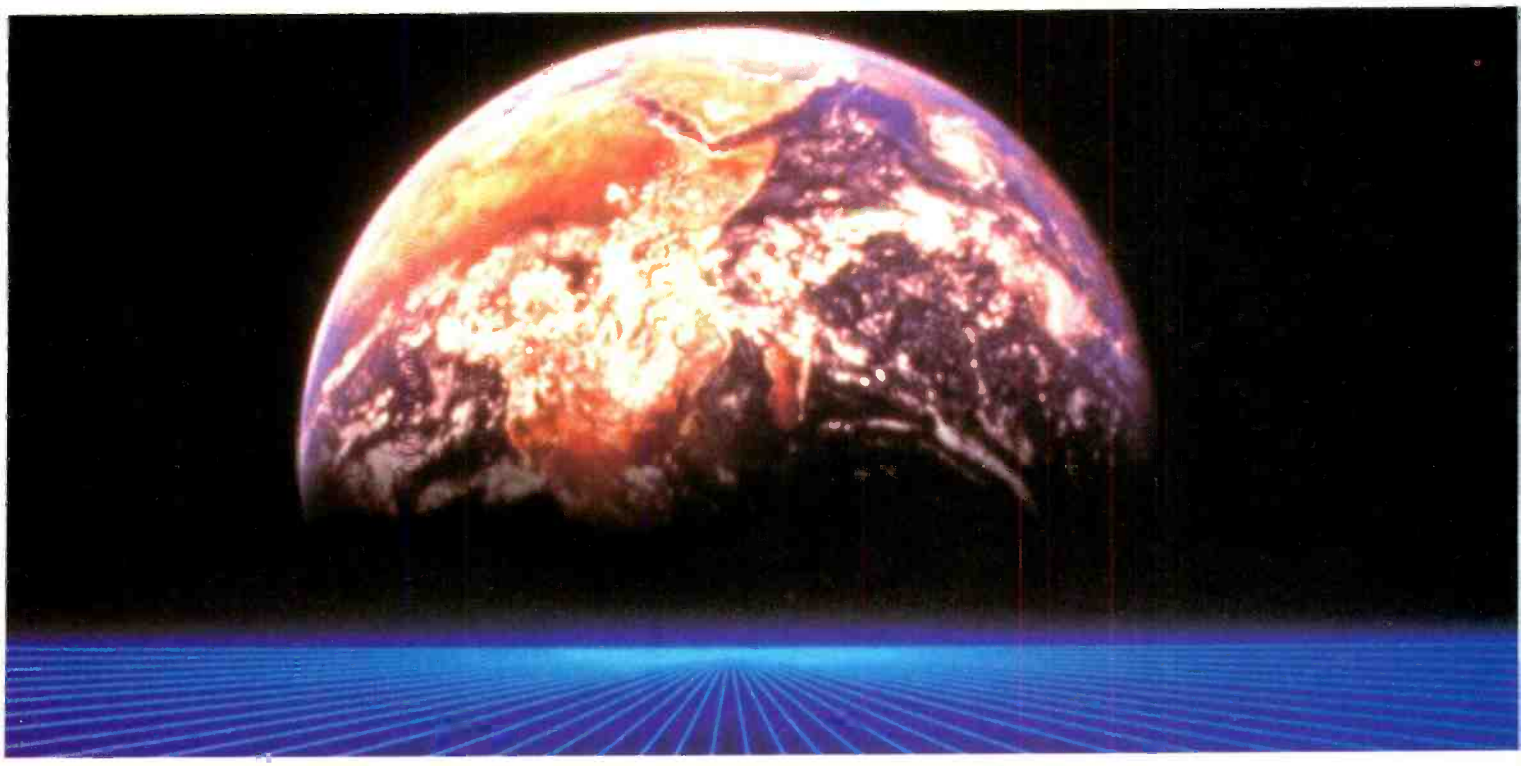

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hand, the tube transmitter probably uses a 4CX3500A in the final amplifier. A new tube will cost around $2,000 or a rebuilt can be had for about $1,100. With care, the tube should last for about two years in a 24-hour-per-day operation.

So, what is left to help you in your decision? The most significant item is efficiency. The 3.8kW solid-state model will draw 10.5kW from the power line. Don't get sidetracked listening to the salesman tell you about amplifier efficiency. All that counts is what shows up on the meter outside of the building. The 5kW tube model will draw 7.9kW from the line when operating at 3.8kW TPO. This will result in a difference of more than $2,200 per year at $0.10/kWH. Now you have a better idea of the real numbers involved and can make a rational, informed decision.

UHF transmitters

The differences grow much faster when looking at UHF TV transmitters. At low power levels, such as 1.0kW for LPTV and translators, the prices are close for either version. As a result, many manufacturers and users have opted for the soft-fail mode with its accompanying reduction in down time. Because of this, solid-state units have essentially taken the market. As the power levels increase, the differences become more apparent.

At a power output of 10kW, one manufacturer offers an excellent tetrode amplifier system. The power consumption for average picture is about 20kW and the cost is less than $200,000. A new solid-state transmitter with a power consumption of 30kW for average picture is just under $400,000. The cost for a replacement tube is much higher than in the previous example, but the number and complexity of the amplifier modules has also increased.

For the next example, we will look at a 30kW transmitter. A single IOT will provide that power level for just under $325,000. The power consumption will be 56kW for average picture with 10% aural. To match this with a solid-state transmitter requires paralleling two 15kW amplifiers. The price would be about $1,100,000 with a power consumption of 92kW. You have to want a solid-state transmitter to swallow those numbers.

Still, the solid-state transmitter could be a viable alternative. For example, a stand-by transmitter in a major market would be much better if it could be placed on the air in seconds rather than waiting for the tubes to warm up. Also, the soft-fail mode is a selling point, especially when a few minutes off the air can cost several thousand dollars in lost revenues.

Conclusion

Changes in technology will continue to reduce the gap between the two transmitter types. One manufacturer has announced a line of solid-state transmitters with liquid-cooled modules, which results in a significant reduction in junction temperature. Reducing junction temperature can double the MTBF of the solid-state devices. As the failure rate of modules is reduced, the gap between price and efficiency is narrowed.

For VHF transmitters, solid-state is about the only choice. For FM units, solid-state devices are becoming a viable alternative with minor real price differences at the lower power levels. At power levels above 10kW, the old-fashioned tube amplifier still appears to be the choice in normal circumstances. For UHF transmitters, the big break-point in power levels appears to be between 1kW and 5kW. For some specific users with well-defined needs, the solid-state transmitter could be the choice. Otherwise, the IOT appears to be the tube of choice for the immediate future. But in another few years, who knows? ■

➡ *For more information on solid-state devices, circle (315). For more information on tube devices, circle (316) on Reply Card.*

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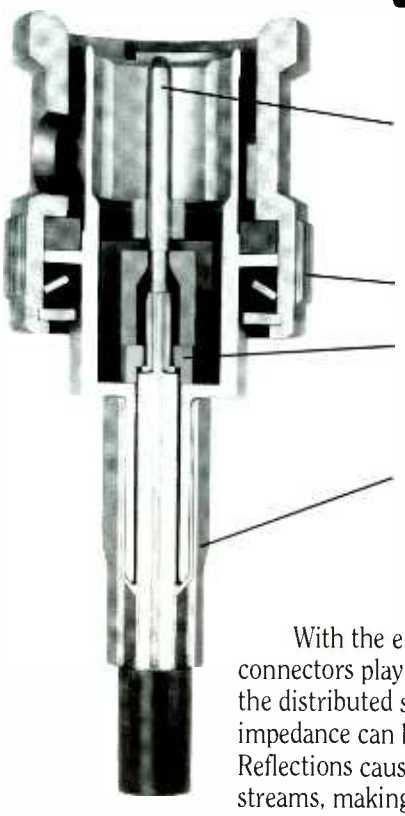

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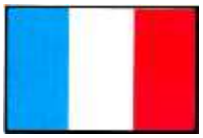
SBE Update

Going international

The International Committee

By Martin Sandberg

Wuxiandian Gongchengshi (Chinese)



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Radio Engineer (U.S.A.)

This is the way "radio engineer" sounds around the world. The universality of broadcast engineering requires that a common platform for the exchange of knowledge and standards be supported and spread about the world. The languages are different, but opportunities for cooperation are the same.

The laws of physics that relate to broadcasting know no political boundaries. The broadcast engineer in Africa and his counterpart in Europe have similar requirements. They face the same problems, work with the same tools and parts, and come up with similar solutions.

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The Society of Broadcast Engineers has taken advantage of this opportunity to share information. SBE members are found in more than 100 chapters and in 25 countries. The society is affiliated with broadcast engineering organizations in Korea, Belize, Mexico, India, Canada, Philippines, Brazil and Uruguay. The local chapters, through their meetings and technical presentations, inform the membership of state-of-the-art developments in broadcast engineering.

Sandberg is a member of the SBE board of directors and chairman of the International Committee. He is also an engineering consultant.

The SBE has established standards for professional competence through the program of certification. The SBE national office provides study guides, SBE Radio Operators Certification Handbooks and certification examinations. These levels of certification are accepted around the world.

The benefit of these affiliations is the sharing of technical expertise, technical papers and friendships. The society is translating the study guide into Spanish, and in the future, will have available study guides and certification examinations in additional languages. The society is exploring a program for the exchange of broadcast engineers with other countries. These exchanges for short periods will permit engineers to view operations and techniques of stations in other countries.

The universality of broadcast engineering requires that a common platform for the exchange of knowledge and standards be supported and spread about the world.

Through the International Committee, the SBE continues to develop communication with broadcast engineering organizations in other countries. If you, or your organization, are interested in learning more about affiliating with the SBE, contact: Chairman, SBE International Committee, Society of Broadcast Engineers, 8445 Keystone Crossing, Ste. 140, Indianapolis, IN 46240 (USA).

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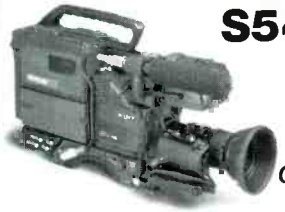

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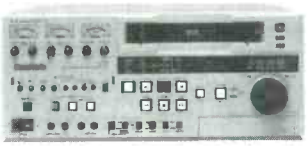

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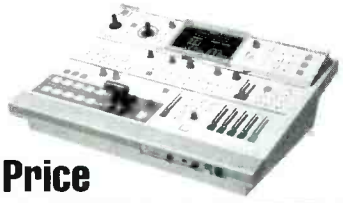

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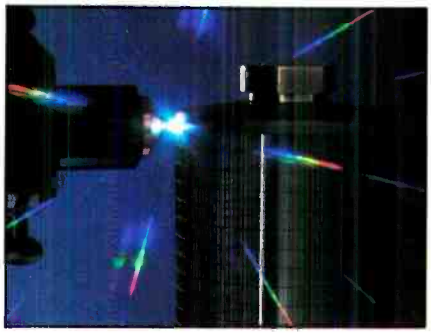
Tektronix Profile



By Jeff Noah

Disk recording technology has been the catalyst precipitating the tremendous success non-linear off-line editing systems have experienced in the last few years. However, the use of disk recorders outside that application has been limited by the image quality they offer or the significant expense of storing relatively small amounts of video.

Tektronix' Profile Professional disk recorder overcomes these limitations in three basic ways. First, it uses many off-the-shelf commodity items from the personal computer industry to minimize cost. Second, it optimizes the motion JPEG compression algorithm and uses high data rates to preserve image quality. Third, it provides an open-platform system architecture and on-board processor to simplify the porting of existing applications or the development of new ones.

Noah is a technical writer for Tektronix Television Division, Beaverton, OR.

Open architecture, standard components

Figure 1 shows the basic architecture and major components of the Profile disk recorder system. The backbone of the system is a 17-slot EISA motherboard with an integral 32x32 CCIR 601 8-bit parallel digital component router. Besides offering speed, the EISA bus makes adding many personal computer peripherals a no-brainer. Controlling the bus is an off-the-shelf PC-on-a-card with an i486DX2/66 processor. A 340MB IDE hard drive and 3.5 inch floppy drive support the processor board.

Because potential applications are broad, the architecture allows many possible combinations of video and audio I/O. With this in mind, all video I/O and analog audio I/O are added as options. Analog composite, parallel composite digital, and serial component dig-

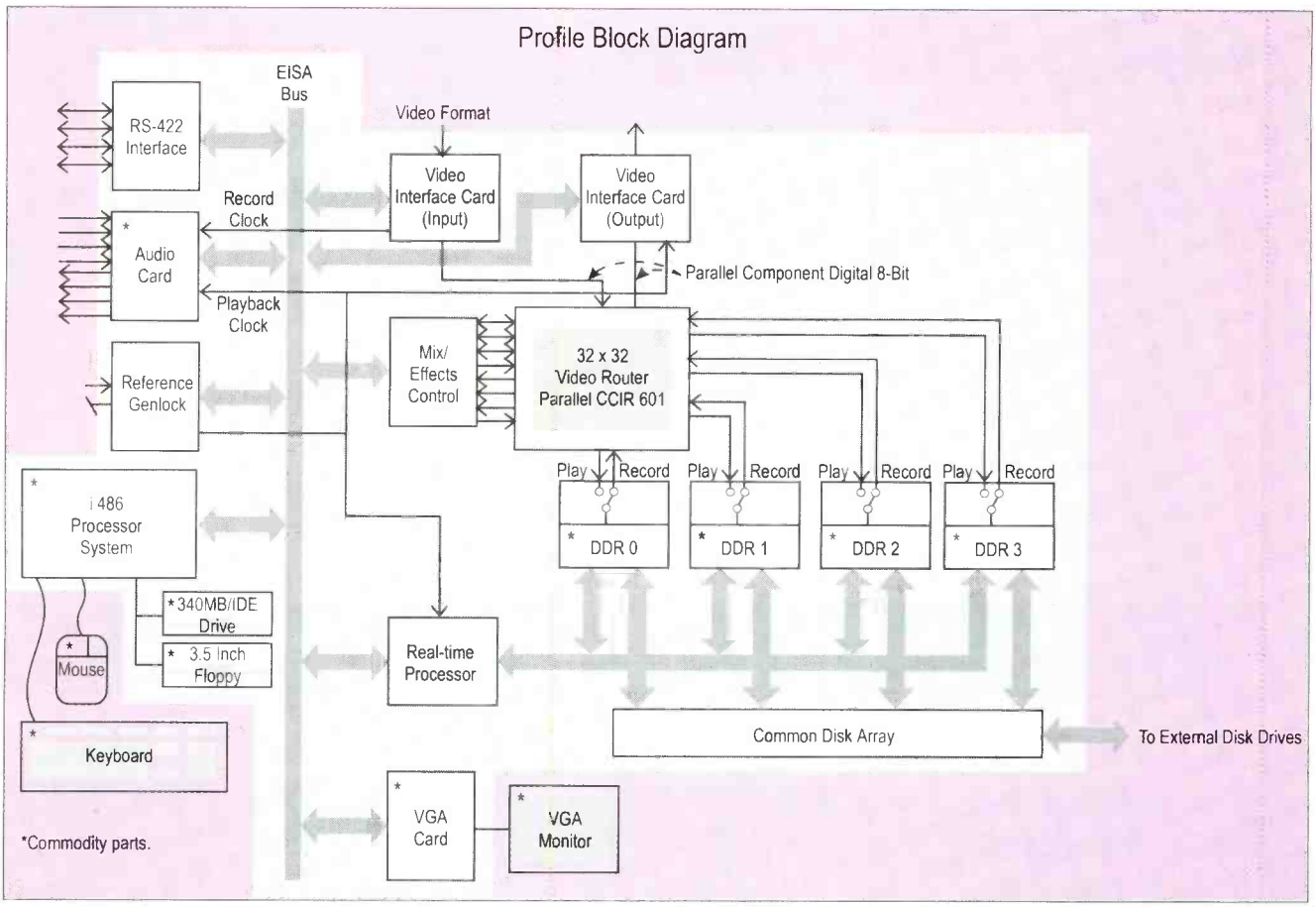


Figure 1. Block diagram of the Profile. Note the use of common computer parts throughout the design, thereby reducing cost and simplifying spare parts requirements.

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ital video I/O are available. Digital audio makes its way into or out of Profile as embedded AES/EBU audio on a serial digital component video channel. Analog audio is digitized at a 48kHz sample rate by an off-the-shelf 16-bit linear PCM digitizer card. All audio is routed over the EISA bus, and Profile allows recording of four channels of digital audio for each video codec channel.

Once video is inside the platform, it travels across the 32x32 router to installed devices. With high-speed video data transfer occurring on the router, the EISA bus is free for control functions and passing audio data. The integral router also eliminates the expense and hassle of an external router and the associated wiring and system timing.

To get video onto and off the disk array, Profile employs motion JPEG codecs and SCSI-2 fast/wide disk control. The base instrument includes one codec/disk controller card that provides two bidirectional codec channels and two SCSI-2 control channels. Achieving four bidirectional codec channels simply requires adding a second codec/disk controller card.

The disk array consists of four or eight 2.1GB or 4GB, off-the-shelf drives providing up to 160 minutes of video storage. An external expansion chassis doubles that capacity by adding up to 16 drives to the array.

Commodity parts keep system costs significantly lower than an architecture built from custom parts. And as technology breakthroughs occur, the modular architecture will accept the best technology the industry has to offer. This open system approach minimizes the expense and difficulty of upgrades, and also eliminates built-in obsolescence.

Careful compression

One of the most significant engineering challenges facing the designers of disk recorders is the balancing act between image quality and storage time. The best image quality requires full-bandwidth recording, but compressionless recording eats up gigabytes at an alarming rate. Conversely, high compression ratios significantly reduce the number of gigabytes per minute needed for storage, but wreak havoc on image quality.

With high-speed video data transfer occurring on the router, the EISA bus is free for control functions and passing audio data.

The backbone of the system is a 17-slot EISA motherboard with an integral 32x32 CCIR 601 8-bit parallel digital component router.

Profile attacks the image quality/storage time/cost equation from two directions. First, all disk drives in the array are commodity items. This avoids the expense often associated with proprietary hardware, while at the same time leaving the platform open to developers of new applications.

Second, the compression coefficients for the motion JPEG algorithm were chosen to optimize image quality, not to maximize bandwidth reduction. The compression ratio can be varied on a field-by-

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field basis to optimize storage time. The resulting image quality level depends on the amount of information in the source material and the available disk I/O bandwidth. The unit is capable of data rates of about 48Mb/s per channel. To achieve image quality equivalent to that of a Betacam SP deck using metal tape, a 24Mb/s per channel data rate is all that is needed.

In contrast to other compression schemes, motion JPEG compression does not introduce motion artifacts. The combination of commodity recording media and optimized compression results in a cost-effective device capable of outputting a video signal with image quality equal to or better than that of a high-end component analog VTR. Storage time works out to approximately five minutes of video (and four channels of digital audio) per gigabyte.

The compression ratio can be varied on a field-by-field basis to optimize storage time.

The video I/O interface boards were designed in-house, using decades of experience to eliminate potential sources of significant video degradation.

Open platform, open opportunities

Subtle design considerations extend the unit's range of applications beyond what might normally be expected in a disk recorder. Up to four video channels can be recorded or played back simultaneously. What's more, the codec channels are not tied to a physical disk or set of disks, meaning any channel can access any information at just about any time. For example, channel one could be writing to the disk array while channels two, three and four could be reading the information written by channel one with only fractions-of-a-second delay. In this mode, Profile could be thought of as a virtual VTR with four sets of heads that could each independently read or write to any spot on the tape.

In order to more closely duplicate the operation of a VTR, all the information contained by the source material is captured — not just picture information — but information in the vertical interval as well. Losing closed-captioning, teletext or Nielsen codes is unacceptable and would eliminate the possibility of using a disk recorder as a play-to-air device in broadcast applications.

Profile could be thought of as a virtual VTR with four sets of heads that could each independently read or write to any spot on the tape.

As mentioned, video and audio I/O cards are added as options. Many of the options take up one or more of the EISA slots on motherboard. Among the options are: an NTSC composite input channel that requires two slots, a card that adds two serial digital component inputs and outputs (one slot), four composite analog output channels (one slot), a composite digital input channel (two slots) and composite digital output channel (one slot). A video combiner card can be added for mix effects (one slot), and four channels of analog audio input and output also require a single slot. Other options include a 2-button mouse and 101

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Profile applies the best of today's video compression technology to a set of well-defined applications.

key keyboard, an ethernet LAN adapter and 17-inch color monitor and VGA display board. The LAN adapter and VGA card take a single slot each. A bypass and breakout adapter converts the audio DB25 connector to four male and four female XLRs. It can also bypass the inputs to outputs in the event of failure.

Conclusion

Profile applies the best of today's video compression technology to a set of well-defined applications previously considered beyond the scope of traditional uses for disk recorders. Applications already identified for the platform include disk caching for tape library management systems, spot playout, store-and-forward and time delay. With four simultaneous I/O channels and high image quality at a reasonable cost, new applications for the platform continue to surface. ■

The Tektronix Profile, a professional disk recorder that uses optimized motion JPEG compression.

➡ *For more information on the Tektronix Profile, circle (317) on Reply Card.*

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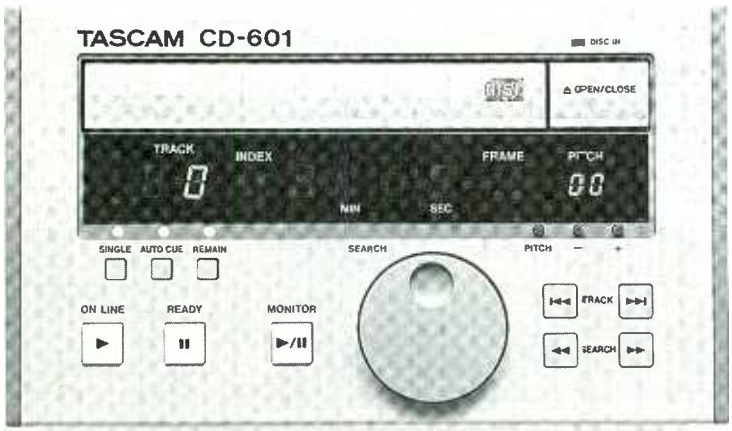

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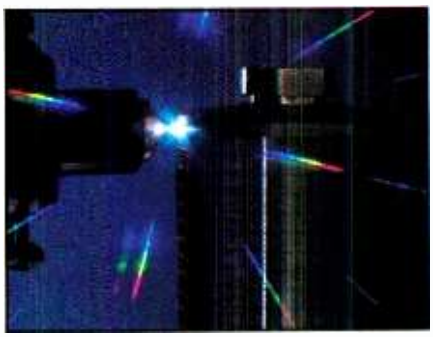
Virtual crosspoints



By Mike Andrews and Steve Monsen

Today, more than ever, facilities are recognizing the need for larger and more powerful routing systems for signal distribution. Many devices, including editors, mixers and preview switchers, are able to control a crosspoint matrix for source selection and auxiliary routing. This demands an overall control system that allows any number of different control devices to control a large router.

In a traditional routing system, the various control systems are isolated by the crosspoints of the various routing switchers that make up the system. What is now needed is facility integration to the point that a single large routing switcher can handle all the needs.

The first digital edit suites used many small routing switchers, parallel digital as well as analog. The three main functions of these routers were: 1) house routing, 2) source selection for switchers, and 3) preview switching. Serial digital routing systems now combine these functions into a single large router, replacing the original two or three routers used in the parallel digital and analog systems.

The AlphieEX, a component digital switcher capable of using virtual crosspoint technology.

Andrews and Monsen are product managers for Utah Scientific, Salt Lake City.

Virtual crosspoints

For the single large router, with internal partitions, to function properly in the system (that is, to preview switch and source select), it must be able to switch in real time. Another problem has been the ability of router partitions to "talk" to each other without wasting external BNC connections. This is where virtual crosspoint technology is used.

Figure 1 shows the evolution of routing systems from analog to large serial digital systems with virtual crosspoints. In Figure 1a, a classic simple routing system is shown with the house router and preview switcher router separate. The outputs of the preview switcher connect to the house router under a house router control system.

With a DYN control system (but no virtual crosspoints) a routing switcher would connect the preview switcher output to the house router. The preview switcher output could be routed to a point in the system by the use of a control panel. A coax cable from the preview switcher output to the house router would be used, as shown in Figure 1b. Figure 1c shows how a virtual crosspoint eliminates the need for the coax and saves one input BNC and one output BNC, replacing them with an internal register connection from a virtual destination (in this example, virtual destination 65 is used) to a virtual source (65). This method frees valuable router crosspoints for other uses.

The beauty of virtual crosspoints is they remove the need for the external connections. Using virtual crosspoints, the routers are able to make connections between router partitions without having to patch between actual input and output connections. A 64x64 router, for example, cannot have any more physical inputs or outputs. It can, however, have internal registers or internal patch panels for the source and destination values.

Virtual crosspoints are in addition to the standard crosspoints of the router. For example, in a

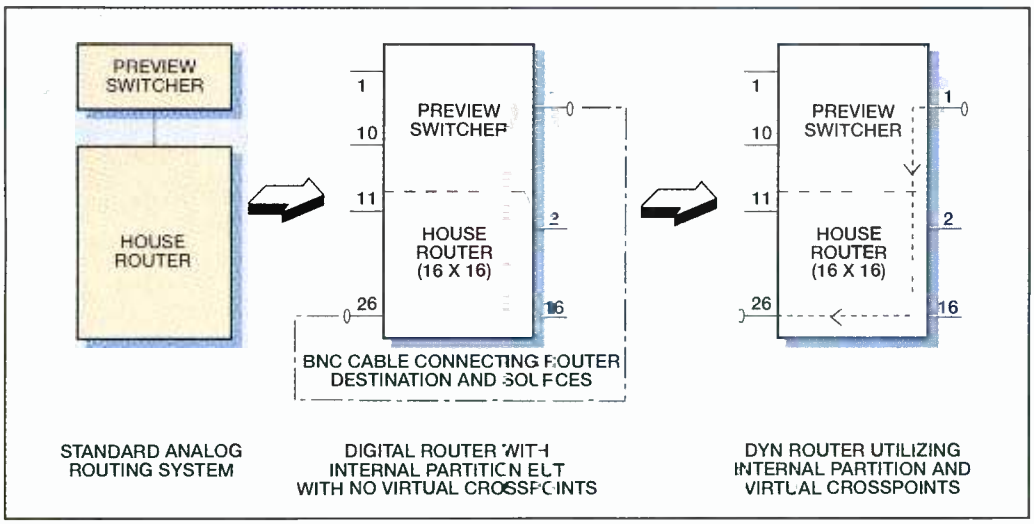


Figure 1. *The evolution of routing switchers, from (a) separate crosspoints and control to (b) separate crosspoints with common control and today, (c) the use of virtual crosspoints.*

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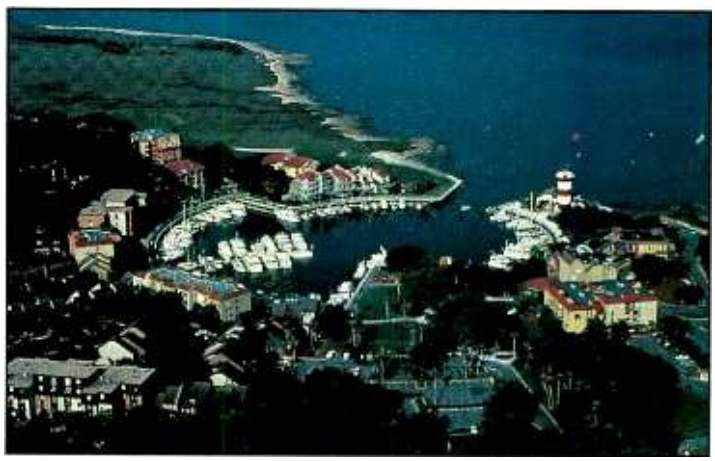

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64x64 DYN router, there are 64 standard crosspoints and 32 virtual crosspoints. In 128x128 configuration of the DYN, there are 64 virtual crosspoints. From an economic viewpoint, it is as if with a 64x64 router, you get an additional 32x32 virtual router. In many applications these extra virtual crosspoints could actually save a facility the expense of buying an additional router.

For a real example, Figure 2 shows a compact component digital switcher (AlphieEX) in a large system. An Alphie can have a maximum of 16 inputs. In this system there are 15 inputs plus a programmable/switchable input. This allows any of the router sources to be connected to the Alphie inputs using a virtual crosspoint and the house router control panel.

The Alphie usually has 16 sources that can be mapped inside the serial router to any of the router outputs, while the house router panel is controlling the auxiliary routing destinations. Using this system, the inputs to the Alphie can be altered only by changing the router mapping using the PC. Applying virtual crosspoint technology to this system, Alphie inputs can be switched from the control panel without using any physical outputs of the router. This is shown in Figure 3.

Further developments in serial digital distribution have arisen as facilities have become more complex, installing, for instance, multiple digital edit suites. Figure 4 shows a facility with four component digital edit suites (two Alpha 500 rooms and two Alphie rooms) running off the Alpha Image MCI (multiple control interface) connected to the central DYN router. Such facility integration had not been available before. In fact, it is now possible to run up to eight switchers using more than one Alpha MCI system.

In addition to the applications with Alpha Image switchers, virtual crosspoints are also useful in broadcast applications, such as master control suites where a master control has a set number of inputs. Like the Alphie system, the house router control panel can be used to provide a selectable input to the master control switcher. The configuration can save one output on the house router and one input on the source selector.

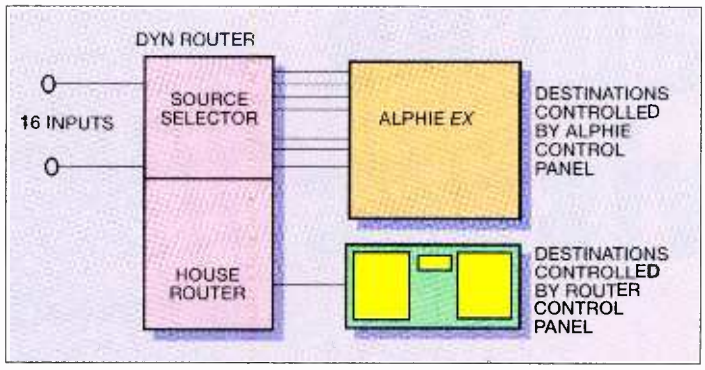

Figure 2. A conventional Alphie system, which has a maximum of 16 inputs, one or more of which can be supplied by a router crosspoint.

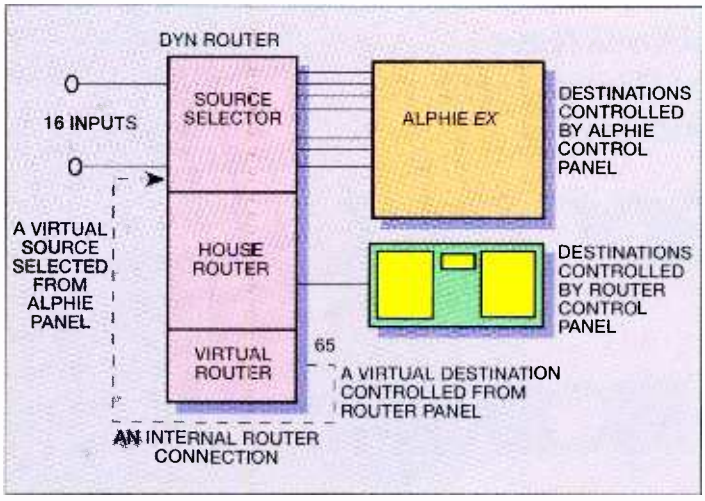

Figure 3. An Alphie system using a virtual crosspoint, which allows the inputs to be selected directly from the Alphie control panel, rather than a router panel. It also frees the router outputs, which are no longer needed.

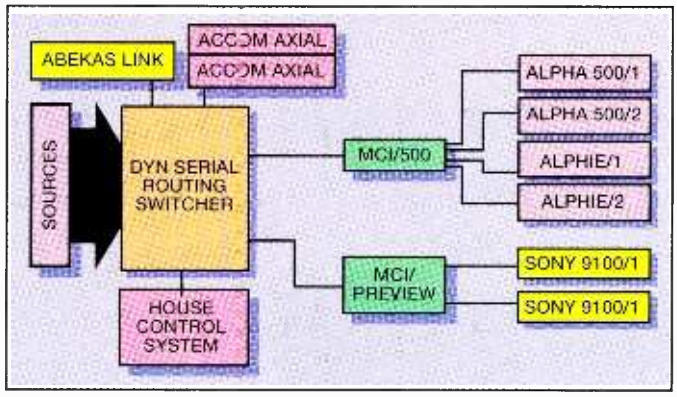

Figure 4. Block diagram illustrating the power of the Alpha Image control system. Using multiple control interfaces (MCIs), the system can be used to feed several switchers.

An unquenchable thirst for quality

Further developments in digital products for broadcasters and post-production houses will be driven by quality issues. Recently, quality issues have lead to increased use of 4:4:4:4 signals in the telecine suites of high-end post-production houses. This translates into the need for routing the 4:4:4:4 signals.

Theoretically, the problem of routing 4:4:4:4 is not difficult. A 4:4:4:4 signal is the same as two serial signals, having a data rate of 2x270 Mb/s. The two signals must be treated as separate signals, and they are not interchangeable. The signals can be routed with existing serial digital technology as long as the 4:4:4:4 signal is treated as a matched pair of signals and is routed to a matched destination pair.

There are two main requirements:

1. D-1, D-2 PAL, D-2 NTSC and 4:4:4:4 can all be routed in the same chassis.
2. Blocking must be ensured when different formats are chosen (i.e., avoid D-1 to D-2 or D-1 to 4:4:4:4 etc.)

DYN routers were designed for the eventuality of 4:4:4:4 and a simple software upgrade is available that allows existing DYN routers to route 4:4:4:4 signals for telecine suites. The software upgrade allows 4:4:4:4 signals to be treated as matched pairs, and allows the user to define different formats all within one router.

Any format can be routed from a standard control system. In addition, the matched-pair solution developed for 4:4:4:4 has other potential applications, such as matched-pair video and key. ■

Editor's note: For additional background on routing systems and virtual crosspoints, see "Three-Stage Switcher Design," September 1991, "Multiformat Routing," September 1991, "CBS Edit 12," March 1994, and the upcoming August feature on "Building Serial Digital Facilities."

➡ *For more information on virtual crosspoint routers, circle (337) on Reply Card.*

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New Products

Video server
By Hewlett-Packard

• **HP broadcast video server:** provides disk-based on-line storage and delivery of six hours to 51 hours of broadcast-quality video and audio; includes the HP Ad Management System and on-line file management software running on a broadcast-control workstation; system architecture is scalable.

Circle (350) on Reply Card

Modular video processing system
By Nova Systems

• **NovaBlox Video Processing System:** new signal processing components and additional chassis configurations.
• **NovaMate XT:** component transcoding TBC/frame sync features YUV, Y/C and composite inputs and outputs; median filter noise reducer/DOC option plus RGB and U-dub in/out options.
• **NovaY/C Max:** image enhancer and Y/C decoder/encoder for sharper pictures; variable Y/C timing correction plus wide-band Y/C and composite transcoding.

Circle (355) on Reply Card

Digital audio tool box
By Nvision

• **Digital Audio Tool Box:** system of three modules for interface, conversion and synchronization; the NV1050 4-channel sample rate converter accepts any AES/EBU format signal at sample rates between 32 and 50kHz; the NV1055 4-channel digital audio mix/minus and routing module allows four channels of AES-format I/O to be intermixed and phase inverted.

Circle (356) on Reply Card

Video server/Editing systems
By Accom

• **Axial 2010 on-line editing system:** offers high-resolution graphics display, simultaneous control of 12 serial devices, EDL timeline displays, and networking capabilities; user definable controls and displays with soft knobs and soft keys.

• **Axial WSE workstation editor:** allows users of paint, graphics, animation, and compositing software running on Silicon Graphics systems to perform on-line editing; interfaces to virtually all VTRs, switchers, mixers; effects devices are standard; features custom Q-Pad user control panel; fingertip controls include jogging, searching, cuing, and mark or set in/out.
• **Brontostore video server:** disk-based storage and presentation system; manages clips containing still frames, real-time video, key, and audio; network can have up to 32 nodes offering up to 53 hours of uncompressed D-1 video plus audio.

Circle (352) on Reply Card

Routing systems
By Dynair Electronics

• **System 2000:** high performance, ultra-compact, video and stereo audio routing systems; routes high-resolution computer graphics video, encoded broadcast video including HDTV, NTSC, PAL and SECAM; 864 to 1,728 video crosspoints and 1,728 to 3,456 audio crosspoints per rack unit.

Circle (354) on Reply Card

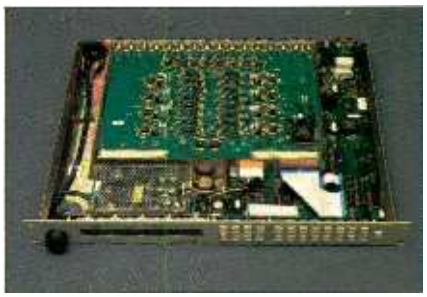
Measurement grade switchers
By Tektronix

• **ASW-100 series measurement grade switchers:** two analog multiplexers; the switchers serve as routing switchers, permitting the inputs and outputs of analog audio test equipment to be switched between multiple signal sources and destinations.

Circle (353) on Reply Card

Scrambling system/Control panel/Sync generator
By Leitch

• **ViewGuard:** new and enhanced high security TV scrambling system; uses "high-tech" digital circuitry; provides transmission over terrestrial and satellite networks; contains ALU for decryption control and authorization and AGC of incoming video.



• **Alphanumeric X-Y remote control panel:** uses an 8-level control system to command all Leitch routers.
• **SPG-1680N sync pulse generator module:** a sync generator on a card; can be housed in any Leitch 680 series video DA frame, or as the SPG-1680MB in a stand-alone, self-powered, mix box.

Circle (351) on Reply Card

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New Products

UHF transmitters
By Harris Allied

• **UltraVision series 5, 10 and 15kW UHF TV transmitters:** available in models for any CCIR system and color formats with NICAM, IRT and BTSC multichannel sound; replaces tubes with broadband (470-860MHz) power amplifiers modules that are interchangeable for visual and aural.

Circle (363) on Reply Card

Camera support equipment
By Cinekinetic

• **Clever Clamp:** camera support that enables camera operator to clamp a camera to any vertical, horizontal or angled support; available with either a 100 or 150mm bowl.

Circle (359) on Reply Card

Parametric equalizer
By dbx

• **242 parametric equalizer:** 5-band, parametric equalizer with three bands of fully parametric peak/dip equalization and two bands of shelving filters; independent control of bands.

Circle (358) on Reply Card

Graphics/Production switcher
By Grass Valley

• **TypeDeko:** a graphics system based on the Windows NT operating system; features special effects including rolls, crawls, fades, dissolves, wipes, flips and tumbles at variable or programmable speeds; video inputs and outputs are composite, Y/C, YUV/RGB and linear key and are selectable as NTSC or Pal.

• **Model 1200 component digital production switcher:** features built-in setup and configuration screen, internal floppy disk drive, direct aux bus control, and auto setup on the chroma key.

Circle (364) on Reply Card

Tape erasers
By Weircliffe

• **BTE 220 shielded tape eraser:** capable of erasing six Hi8 or 8mm metal particle tapes at one time for a throughput of 270 tapes per hour; shielded to restrict exposure of non-ionizing low-frequency electromagnetic radiation; can be connected to a standard 120V power source.

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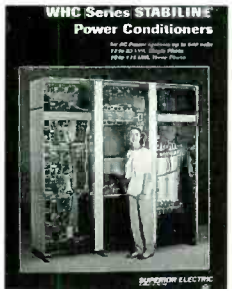
New Products

Fiber-optic video transmitter
By Math Associates

• **Fibercube:** self-contained fiber optic video transmitter designed to convert CCTV cameras and other video signal sources to fiber optics; FX-5505 module clips onto the BNC video output connector of the camera.

Circle (360) on Reply Card

Power conditioners catalog
By Superior Electric



• **Catalog WHC194:** an 8-page catalog describing WHC series STABILINE power conditioners for AC power systems up to 600 VAC; units feature ratings from 12 to 33kVA single phase, 10 to 125kVA three phase.

Circle (361) on Reply Card

Oscilloscope
By B+K Precision

• **Model 2190A:** an improved 100 MHz, 3-channel, 6-trace oscilloscope; maximum sensitivity is 1mV per division, accuracy is better than 3%, and rise time is less than 3.5ns; sweep speed is adjustable from 50ns/div. to 0.5s/div. in 22 calibrated steps with fine adjustment.

Circle (371) on Reply Card

Monitor for surround sound
By Wohler Technologies

• **AMP-SUR:** housed in a magnetically shielded 2U chassis, incorporates surround sound decoder, LED level meter for all four channels.

Circle (368) on Reply Card

HDTV recorders
By Recognition Concepts

• **HDTV Series:** line of digital video disk recorders; four disks combined by adding a video interface card that conforms to the SMPTE 240/260M HDTV standard.

Circle (365) on Reply Card

Audio restoration device
By HHB/Cedar

• **AZ-1 Azimuth Corrector:** detects and corrects phase problems and time delays left between left and right channels of stereo signals; easy to operate.

Circle (366) on Reply Card

Routing switcher
By Knox Video

• **RS12x2 matrix routing switcher:** stereo audio/composite video router in a streamline 1½" chassis; front panel push-button operation and can also be controlled via RS-232 input; front panel LED indicators display present routes at all times.

Circle (367) on Reply Card

AS-101 Audio Switcher

- Illuminated and legendable control buttons
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SIERRA DESIGN LABS

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New Products

Surge suppressors
By EFI

• **Omni-Phase power line filters:** improved version of transient voltage surge suppressors featuring an audible alarm, a new system for internally encapsulating the suppressor elements for increased safety, and an optional weather-tight enclosure for installation in rugged operating environments.

Circle (362) on Reply Card

RF power measurement products
By Bird Electronic Corporation

• **Moduload series RF load resistor:** self-cooled transmission line termination; ideal for CW, AM, FM, SSB, TV and pulsed transmission systems.

• **Model 6085 broadband high-power RF calorimeter:** fast, accurate, and easy-to-operate power measurement; measurement uncertainties of better than +/-3% of readings; optional interface board available for automated testing applications.

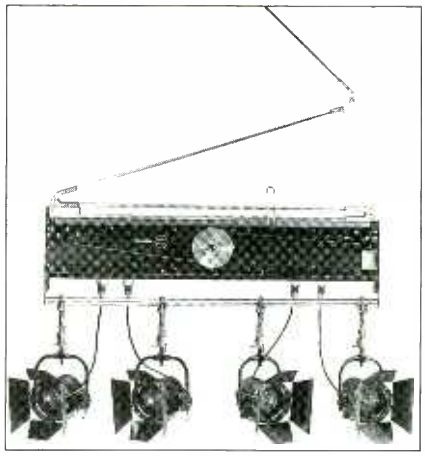
Circle (357) on Reply Card

Portable broadcast mixer
By AEQ

• **TLE-02:** portable broadcast mixer with frequency extender; allows 2-way communication to two totally independent wires through the digital hybrid incorporated within the equipment; functional with two or four wires; features three audio inputs and auxiliary program output; universal power supply via transformer or eight batteries

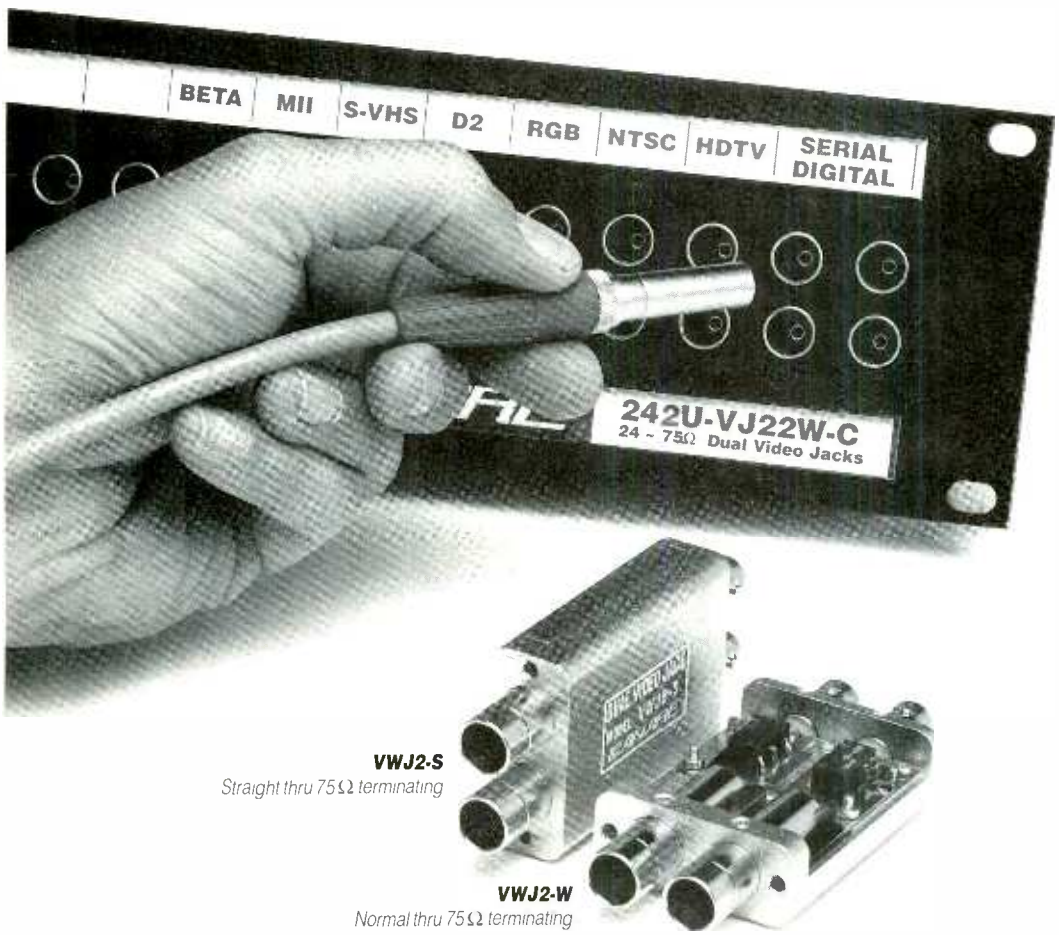
Circle (372) on Reply Card

Suspension and lighting
By Sachtler



• **Teleclimber:** a barrel hoist with a rated payload of more than 140 kg (310 lbs) weighing less than 90 kg (195 lbs), able to take 4 metric tons.

Circle (369) on Reply Card ■



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VWJ2-W
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Industry Briefs

BUSINESS SCENE

Sachtler, Munich, Germany, received an order to equip four new studios for TV Globo, Brazil, with Sachtler Gridclimbers, Scenery Hoists, Pantographs, Lite Trolleys and 2kW and 5kW fixtures. Sachtler AG, Munich, developed Gridclimber hoists based on the well-proven Sachtler hoist modules.

Sony Electronics, Montvale, NJ, was selected by the Associated Press as primary provider of equipment for APTV, AP's international TV news service to be launched later this year.

Sony sold several Digital Betacam VTRs to CBS Television City and Entertainment News Television. Americom purchased a Sony Library Management System with six Sony Digital Betacam VTRs

Leitch, Chesapeake, VA, was awarded a multimillion dollar contract to supply each of NBC and Fox Broadcasting Company with ViewGuard encryption systems to scramble broadcasts of the National Football League games, commencing in September 1994.

McCurdy Radio Industries, Toronto, and **Philip Drake Electronics**, England, have joined forces in an international marketing and manufacturing agreement. McCurdy Radio will manufacture and market the Drake DCS3000 Digital Communications System in North America. Philip Drake will market the McCurdy M/2000 Broadcast Automation System and the McCart digital audio storage system throughout Europe.

Magni Systems, Portland, OR, marks its tenth anniversary this month and celebrates the milestone with key customer start-up and operation on its newest video monitoring product, and announcement of nine major patent awards.

Video Design Pro, Las Cruces, NM, received an order from PESA, Atlanta, for VidCAD engineering automation software. PESA will supply Atlanta Olympic Broadcasting, 1996, with broadcast equipment and systems designs, installation and integration.

Solid State Logic, Oxford, England, installed one of the latest SSL G Plus consoles with Ultimation as part of a major refurbishment of The Town House Studios, London.

Quantel, Darien, CT, has opened a new headquarters office in Dallas to service the South Central region (TX, LA, OK, MS, and western TN). The address is: The Meridian Building, 1425 Greenway Dr., Suite 470, Irving, TX 75038.

Quantel also sold customized Picturebox packages to: FOX TAPE, Hollywood; KCBS-TV, Los Angeles; KDAF-TV, Dallas; WCVB-TV, Needham, MA; WLWT-TV, Cincinnati; and WRC-TV, Washington, DC.

Arrakis Systems, Fort Collins, CO, and **Gentner Communications**, Salt Lake City, have introduced new technology protocol and product systems resulting from a strategic alliance between the two companies. The protocol, GAP², which defines the method of linking telephone technology to hard disk studio systems, is the platform on which the companies' new "Smartphone Systems" family is based.

Continued on page 92

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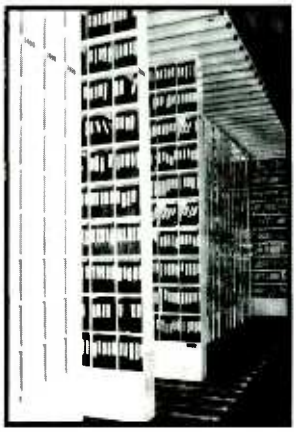

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Industry Briefs continued from page 91

ENCO Systems, Farmington Hills, MI, has relocated its headquarters to the Detroit, MI, area. For more information, contact: ENCO Systems, 24403 Halsted Rd., Farmington Hills, MI 48335-1669; phone 800-362-6797 or 810-476-5711; fax 810-476-5712.

Comark Communications, Colmar, PA, acquired the RCA Broadcast Transmitter Service Business & Parts from General Electric.

Harrison by GLW, Nashville, TN, and **AT & T Digital Studios Systems**, Greensboro, NC, announced a strategic alliance for the development and delivery of digital products.

Vyvx, the TV services affiliate of WilTel, Houston, and **VDI**, Los Angeles, have announced the formation of a service to deliver spot advertising to local TV broadcasters.

360 Systems, Westlake Village, CA, moved to a new facility. The address is: 5321 Sterling Center Dr., Westlake Village, CA 91361; phone 818-991-0360; fax 818-991-1360.

TouchVision Systems, developers of D/Vision, Chicago, sold 20 turnkey D/Vision-Pro systems to CBS News.

Comprompter, La Crosse, WI, installed Comprompter's complete electronic newsroom system with 20 workstations at NBC affiliate WPSD-TV. Comprompter also installed a small electronic newsroom at WYHS-TV, Miramar, FL.

Fast Electronics U.S., Natick, MA, has moved its corporate headquarters to the Silicon Valley area. The new address is: One Twin Dolphin Dr., Redwood City, CA 94065; phone 415-802-0772; fax 415-802-0746.

PEOPLE

John Schwan has been named vice president worldwide sales for the production business unit of Dynatech Video Group, Salt Lake City.

Robert L. Wilson has been appointed executive vice president, chief operating officer, and chief financial officer for Accom.

Daniel W. Castles has been appointed president of Grass Valley Group, Inc., Grass Valley, CA, a subsidiary of Tektronix.

Stanley D. Becker and **Robert M. Polan** have been appointed to positions with Louth Automation, Menlo Park, CA. Becker will be responsible for engineering management and product development. Polan will be responsible for all southeastern and northeastern U.S. sales.

Gerald R. Jensen has joined Comprompter, Inc., La Crosse, WI, as an account representative for computer newsroom sales.

Patrick A. Burns has been appointed vice president and general manager of West Coast operations of the Chyron Corporation, Melville, NY.

Alex Osadzinski has been named vice president of marketing at the Grass Valley Group, Grass Valley, CA,.

Steve Gordoni has joined 360 Systems, Tarzana, CA, as sales engineer. ■

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WITH **TIME/TEMP** OPTIONS

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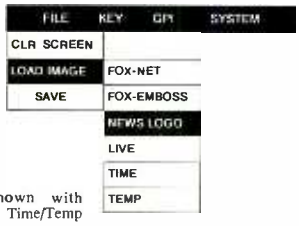
C) Save your logos to a 3.5" floppy and ...

the 908 does the rest!



Logo shown with embossed Time/Temp display

Video Output

Menu Output

Features:
- 24 bit (paletted) color
- Built in linear keyer
- 8 Programmable GPI ports
- Linear fader
- Mouse controlled menu driven
- Reposition logos
- Transparency adjust
- Separate menu output
- 1 rack unit high
- Stand alone

Programmable GPI Macros: The 908 series allows the user to construct powerful **automated programs** that will execute with a simple contact closure. Programs are assembled on the menu output using an internal command structure. They may then be saved to disk and or linked to any one of the 8 GPI contacts located on the 908 rear panel.
Example: A GPI macro could be constructed to perform the following: load a logo from disk, fade logo onto screen, wait 1 minute, fade logo off screen, wait 20 minutes, repeat and continue until GPI contact releases.

Time and Temp Option: This version of the 908 enables the reception of RS232 data from various devices for on screen updating of time, temp, latitude and longitude,etc. Users can design thier own fonts or use the fonts provided with the 908TMP

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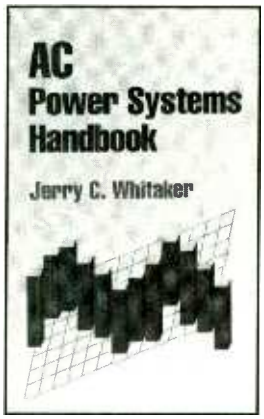

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970 Power-MAX

The 970 Power-MAX is designed for power-hungry professionals who have high-current draw situations and long run times.

- Highest capacity quick-charge capable 12 Volt 14-AMP sintered nicad power pack (removable).
- Rugged high-grade, black leather belt case; chassis assembly with dual 3-pin XLR inputs for pack interchange without shutdown.
- 2,500-cycle cell life provides lowest cost per cycle.
- Microprocessor-controlled 5-step multi-colored power indicator display.
- Belt with cellpack weighs a comfortable 7.5 lbs.
- Charge in little over two hours with the optional 650-III Intelliquick Fast charger.
- Dual outputs allow simultaneous powering of two devices (eg. camera and light). Output configurations include cigarette lighter and 4-pin XLR in any combination.
- Includes Power-MAX belt and power chassis, 14-amp cell pack in 12V or 13.2 volt configuration, model 600 overnight charger, comprehensive owner's manual. Fits waist size 29"-44".

VARI-LITE PRO

Professional DC On-Camera Light

Thanks to on-board control IC's using NRG's Light-Gate technology, light intensity can be infinitely adjusted by the user within a range of 10% to 100% of the lamp's rated power. You can instantly adjust light output to exactly meet changing light requirements, all without changing hot bulbs or fussing with power rabbit diffusion filters. Best of all, the Vari-Light Pro virtually eliminates color shift and dramatically conserves precious battery power by using only the power required for the selected light level. Accomodates bulbs from 20W to 100W DC.

- Prismatic Pyrex dispersion grid provides smooth even light ouput and reduced glare without changing light intensity.
- Sturdy all-metal click tilt mounting bracket with unique ratchet action. Eliminates shake during action shooting.
- Front retainer assembly pops off for instant bulb access without the bother of screws.
- Rugged milled aluminum light head disperses heat and provides years of service under adverse conditions.

Power Station Series

Designed to replace expensive original-manufacture AC power supplies, the affordable Power Stations deliver precisely-regulated 12-volt DC power from AC sources worldwide. High-current capability allows for powering not only large camcorders, dockables, decks, and cameras, but lights, monitors, and other high draw 12-volt equipment as well.
The stations provide up to 9 amps of precisely regulated DC power eliminating the need for battery power in stationary applications where an AC source is available. The Power Stations exceeds all original manufacturer performance specifications.

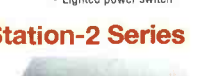
- Available in different configurations: The 12560 features a single cigarette or 4-pin output and up to 5 amps of output current. The 129100 features dual outputs in any combination of cigarette or 4-pin and 9 amps of output current capability.

Features:

- High-current output
- Worldwide voltage selection
- Rugged steel case
- 4-pin or cigarette lighter outputs
- Lighted power switch

Power Station-2 Series

Just plug the PowerStation-2 into any AC outlet in the world and out comes perfectly regulated 12-volt DC power through four 4-pin XLR connectors and one cigarette lighter connector. It uses an advanced pulse-width-modulated power supply which allows for ultra-light weight and small size. It operates with little heat even at full output. The PowerStation-2 is the ultimate multiple-output professional power source for cameras, decks, lights, monitors, and a host of other video accessories.



- 85-264 volts worldwide auto-adjusting input (just plug in).
- Supply is fully protected from overcurrent.
- Ultra-light weight - under 3 lb.
- Outstanding 300,000 hour mean time between failure is far in excess of any other manufacturer.
- Ultra-efficient PWM regulation generates far less heat than linear type supplies.
- Provides the ultimate in performance and reliability in a universally compatible and compact package.

Panasonic

Broadcast & Television Systems

WJ-MX50 Digital A/V Mixer

- Four input switcher and any two sources can be routed to the program busses
- Two-channel digital frame synchronization permits special effects in each of the A/B busses.
- Combination of 7 basic patterns and other effects creates 287 wipe patterns.
- External edit control input for RS-232 or RS-422 serial controls. Also has GPI input.
- Wipe boundary effects: soft/border (bold, 8 back colors available)
- Digital effects including strobe, still, mosaic, negative/positive, paint, monochrome, strobe, trail, and AV synchro
- Real-Time compression - the entire source image is compressed inside a wipe pattern
- "Scene Grabber" makes it possible to move a pattern, upholding the initially trimmed-in picture integrity.
- Non Additive Mix (NAM): selects between A and B sources, passing only the signal with the highest luminance value.
- Fade-in and fade-out video, audio, titles individually or synchronously faded.
- Down stream keyer with selectable sources from character generator or external camera.
- Incorporates 8 separate memories that enable virtually instant recall of frequently used effects
- 8 preset effects include: Mosaic Mix, Position Stream, Corkscrew, Bounce, Flip, Shutter, Vibrate, and Satellite.
- Audio mixing capability of 5 sources with 5 audio level adjustments.

NEW! AG-DP800 SUPERCAM

S-VHS FIT 3-CCD Digital Signal Processing Camcorder

- Three high-density 380,000 pixel CCDs with half-pitch pixel offset to over 700 lines of horizontal resolution, a S/N ratio exceeding 60dB and remarkable sensitivity of f8 at 2000 lux result in simply extraordinary image quality. Additionally the Frame Interline Transfer (FIT) CCDs minimize vertical smear, so you maintain impressive picture quality even in very bright illumination.
- Uses advanced digital signal processing circuitry which provides four valuable benefits.
  1) Consistently reliable up-to-spec performance.
  2) Fine adjustment of a wide range of parameters.
  3) Memory storage and instant recall of specific settings.
  4) More flexible and higher quality image processing, as well as easier maintenance.
- Some of the DSP circuits and their functions:
  - CHROMA DETAIL - This function compensates for poor resolution in the high chroma areas of the picture.
  - DARK DETAIL - Determines optimum degree of contour enhancement in dark areas to deliver crisp, natural-looking images.
  - HIGHLIGHT COMPRESSION - Expands the dynamic range of the highlighted areas and prevents halation. The highlight compression circuit allows a wide dynamic range producing detailed images even against bright backlight or daylight.
  - FLARE CORRECTION CIRCUIT - Compensates for unsteady black caused by light or by a subject's movements.
- Six Scene File modes. There are two user modes for custom digital parameter settings including Horizontal Detail, Vertical Detail, Chroma and Dark Detail, and Color Correction. The four preset modes are normal, fluorescent, special and sparkling.
- In addition to regular AGC (Automatic Gain Control), Supercam has a Super High Gain mode. At F1.4 this enables shooting under illumination as low as 2 lux while retaining detail and color balance.
- Synchro Scan function allows flicker-free shooting of computer monitors. Electronic shutter increments can be set variably from 1/61 seconds to 1/253 of a second.
- Built-in internal time code generator lets you record with SMPTE LTC/VITC (Longitudinal/Vertical Internal) time code
- 26-pin connector for direct signal output from camera section for easy backups using 2nd VCR equipped with 26-pin connector.
- Two hi-fi stereo audio channels with a dynamic range of 80 dB, as well as two linear audio channels with Dolby NR. Normal/Hi-Fi recording is selectable and the levels of all four channels with Dolby NR. Normal/Hi-Fi recording is selectable and the levels of all four channels are controllable. Uses XLR connectors to further ensure high-quality sound.
- Phantom power can be supplied to an optional microphone. Power can be switched off to prevent battery drain when not in use.

NEW! AG-DS840/AG-DS850

S-VHS Slow-Motion Editing System

Editing machines truly designed for professionals

The AG-DS840 player and AG-DS850 Editing VCR are state-of-the-art S-VHS editing machines that provide the quality required for professional video production and even broadcast systems. Equipped with Panasonic's advanced digital technology they offer features such as Digital VHS Circuitry, Digital 3-D Time Base Correctors, Digital Slow Motion, and Digital Noise Reduction. They also have built-in Time Code Generator/Readers for frame accurate editing, and component video output for connection to MII and Betacam machines.

AG-DS840 & AG-DS850 Features:

- They provide clear, noise-free, high quality slow playback. Playback speed, including Digital Still is selectable in 10 steps (-1/4, -1/8, -1/16, -1/25, D, -1/25, +1/16, +1/8, +1/4, +1/2).
- Built-in enhanced performance, 3-dimensional digital TBC with a correction range of one field. With the VCRs continuously retaining one field in memory, the data is used for 3-D type processing thereby providing excellent dropout compensation.
- Digital Signal Processing for improved picture quality, and for maintaining uniform picture quality during editing. A Chrome Aperture Compensation (CAC) circuit eliminates color blurring and expands chroma bandwidth.
  Other digital processing circuits include:
  - Digital Noise Reduction (DNR): Processes Y and C signals separately to boost S/N Ratio by minimizing noise during playback.
  - Digital Comb Filter: Uses an advanced 3-dimensional system for complete Y/C separation. The result is reduced color and luminance blurring.
  - Switching Noise Mask Circuit: Effectively eliminates noise caused by head switching during slow motion playback.
- Employs amorphous video heads that have a higher magnetic coercivity than conventional ferrite heads. Expanded color signal frequency response from the amorphous heads enhances picture quality by minimizing color blurring.
- They have built-in LTC/VITC (Longitudinal/Vertical Interval) time code reader/generators for absolute frame accurate editing.
- Equipped with component outputs allowing easy connection to other component video equipment. This allows high quality transfer of S-VHS source material to Betacam or MII.
- Equipped with RS-422 (9-Pin) serial interface. The standard control system for professional broadcast machines.
- IQ (Intelligent Quest) mechanism delivers precise, high-speed operation, plus the reliability needed. The dual-loading system achieves high-speed response while protecting tapes and heads from damage. The tape transport mechanism uses five direct drive motors, including two reel drive motors. Automatic head cleaning is also provided.
- Capstan Control System with large capstan spindle allows high-speed search at 32x normal speed.
- Four channel audio including two hi-fi stereo channels with a dynamic range of 90dB as well as two linear channels with Dolby NR. Each audio channel has its own input (AG-DS850 only) and output with individual channel-level setting capability. All audio channels use XLR connectors.
- Provides 16:9 wide aspect compatibility, so they are fully equipped for the next generation of televisions.
- 3 rack units high, they are unbelievably compact for easy space saving installation. 19" rack-mountable with optional AG-M730.

LEADER

Model 5850C

Vectorscope

An ideal companion for the 5860C Waveform Monitor, the 5850C adds simultaneous side-by-side waveform and vector monitoring. Featured is an electronically-generated vector scale that precludes the need for fussy centering adjustments and eases phase adjustments from relatively long viewing distances. Provision is made for selecting the phase reference from either (A or B) inputs or a separate external timing reference.

Model 5860C

Waveform Monitor

A two-input waveform monitor, the 5860C features 1H, 1V, 2H, 2V, 1 µs/div and 2V MAG time bases as well as vertical amplifier response choices of flat, IRE (low pass), chroma and DIF-STEP. The latter facilitates easy checks of luminance linearity using the staircase signal. A PIX MON output jack feeds observed (A or B) signals to a picture monitor, and the unit accepts an external sync reference. Built-in calibrator and on-off control of the DC restorer is also provided.

Model 5864A

Waveform Monitor

A fully portable waveform monitor for field use, the Model 5864A is a two-channel unit that provides 2H and 2V sweeps with MAG, FLAT and IRE response, and normal and X4 gain.

Model 5854

Vectorscope

2-channel portable vectorscope is ideal for field use and features A and B phase reference, fixed and variable gain. Both units shown with optional battery holder and NP-1 type battery.

MAGNI®

MM-400

- The MM-400 is a combination waveform and vector monitor especially configured for the cost-conscious producer. A low-cost alternative to CRT-based waveform monitoring the MM-400 produces a video picture of the input signal's waveform and displays it on any video monitor. It provides a simple, affordable and accurate way to set camera levels before a shoot, or to check time base correctors and color fidelity in editing. Problems like hue shift, smearing, muddy contrast and loss of detail are easily identified for correction.

FEATURES:

- Converts waveform or vector display information into a standard video signal which can be displayed on a video monitor or routed around a video facility, no need for additional expensive monitors. Switch between pictures and waveforms at the push of a button.
- Incorporates an advanced SC/H phase and color frame indicator that is a must for editing and post production. At a glance it tells you if a signal's subcarrier-to- horizontal phase is properly adjusted and if the signal's color frame matches the house black burst connected to the MM-400 external reference input.
- Works anywhere and with any analog video format—NTSC, PAL, Component or S-Video. It has automatic detection between NTSC and PAL formats.
- Three loop-through inputs can accept three composite signals or one component, or RGB signal
- No complex displays or special test signals are required for component video monitoring
- Interchannel timing and amplitude display make component analog monitoring easy, has color bar limit markings for Betacam, M-II and SMPTE formats.
- Waveform and vectorscope controls, including channel, sweep speed, position control, phase rotation are on easy-to-see dedicated pushbuttons.
- Besides instant toggling between picture and waveform, a mix mode combines waveform and picture displays for simultaneous viewing.
- The MM-400 can be readily used by even novice operators. It has easy-to- understand set-up menus for display color, Interchannel timing, SC/H phase alarm.
- Usable in any video facility of any size for displaying signals, its low cost makes it affordable by the smallest studio, while its features and performance make it ideal for monitoring in high-end facilities as well.

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P660HMP	7.19	E660HME	11.29
P6120HMP	9.69	E6120HME	15.79

AMPEX

187 KCA 3/4" U-matic Broadcast (In Box)

KCAD5	6.49	KCA10	6.89	KCA15	7.29
KCA20	7.69	KCA30	8.49	KCA60	11.79

197 BCA 3/4" U-matic Master Broadcast (In Box)

BSC10 (mini)	8.49	BCA10	8.54	BCA20	9.59
BCS20 (mini)	9.59	BCA30	10.20	BCA60	14.39

297 SPA 3/4" U-matic SP Master Broadcast (In Box)

SPS10 (mini)	10.21	SPA10	10.20		
SPA20	10.85	SPS20 (mini)	10.85		
SPA30	12.40	SPA60	16.20		

208 Betacam Master Broadcast (In Box)

BC-5A (small)	4.89	BC-10A (small)	5.89
BC-20A (small)	7.59	BC-30A (small)	9.69
BC-30LA	12.69	BC-60LA	23.49 BC-90LA 30.99

398 Betacam SP Master Broadcast (In Box)

BC-5A (small)	15.99	BC-10A (small)	18.49
BC-20A (small)	20.49	BC-30A (small)	22.39
BC-5LA	15.99	BC-10LA	18.49
BC-20LA	20.49	BC-30LA	22.39
BC-60LA	29.95	BC-90LA	46.95

maxell

BQ Certified 8mm High-Grade

P6-60 HG BQ	4.99	P6-120 HG BQ	6.49

BQ Certified Hi-8 Metal Cassettes

P6-60 HM BQ	6.49	P6-120 HM BQ	8.49

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T-30 Plus	2.29	T-60 Plus	2.59
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HGX-PLUS Expitaxial VHS (Box)

HGXT-60 Plus	3.49	HGXT-120 Plus	3.79

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T-30 BQ	5.49	T-60 BQ	5.99
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BQ Certified Professional S-VHS (In Box)

ST-31 BQ	6.49	ST-62 BQ	6.99
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KCA 3/4" High Grade w/Album & Sleeve

KCS-10 HG (mini)	6.99	KCS-20 HG (mini)	7.69
KCA-5 HG	7.29	KCA-10 HG	8.29
KCA-20 HG	8.99	KCA-30 HG	9.49

KCA 3/4" Broadcast w/Album & Sleeve

KCS-10 BQ (mini)	7.49	KCS-20 BQ (mini)	8.49
KCA-5 BQ	7.69	KCA-10 BQ	8.29
KCA-20 BQ	8.99	KCA-30 BQ	9.99

SONY

Hi-8 Professional Metal Video Cassettes

P6-30 HMPX	5.99	P6-30 HMEX	8.49
P6-60 HMPX	8.59	P6-60 HMEX	11.99
P6-120HMPX	11.69	P6-120HMEX	15.99

PR Series Professional Grade VHS

T-30PR	2.49	T-60PR	2.79	T-120PR	3.29

PM Series Premier Grade Professional VHS

T-30PM	3.49	T-60PM	4.09	T-120PM	4.99

BA Series Premier Hi-Grade Broadcast VHS (In Box)

T-30BA	3.79	T-60BA	4.29	T-120BA	5.29

MQ Master Quality S-VHS (In Box)

MQST-60	8.19	MQST-120	8.59

BRS 3/4" U-matic Broadcast Standard (In Box)

KCS-10 BRS (mini)	7.99	KCS-20 BRS (mini)	8.69
KCA-10 BRS	7.89	KCA-20 BRS	8.39
KCA-30 BRS	9.29	KCA-60 BRS	12.99

XBR 3/4" U-matic Broadcast Master (In Box)

KCS-10 XBR (mini)	8.49	KCS-20 XBR (mini)	9.79
KCA-10 XBR	8.99	KCA-20 XBR	10.29
KCA-30 XBR	11.49	KCA-60 XBR	14.99

KSP 31/4" U-matic SP Broadcast (In Box)

KSP-S10 (mini)	9.19	KSP-S20 (mini)	10.69
KSP-10	9.69	KSP-20	10.99
KSP-30	12.49	KSP-60	16.39

BCT G Betacam Broadcast Standard (In Box)

BCT-5G (small)	4.99	BCT-10G (small)	5.89
BCT-20G (small)	7.39	BCT-30G (small)	9.39
BCT-5GL	9.29	BCT-10GL	10.39
BCT-20GL	11.69	BCT-30GL	12.89
BCT-60GL	23.99	BCT-90GL	30.90

BCT Metal Betacam SP Broadcast Master (Box)

BCT-5M (small)	16.99	BCT-10M (small)	19.29
BCT-20M (small)	21.29	BCT-30M (small)	23.29
BCT-5ML	16.99	BCT-10ML	19.29
BCT-20ML	21.39	BCT-30ML	23.49
BCT-60ML	31.99	BCT-90ML	49.95

SANYO GVR-S950

S-VHS Single Frame Recording VCR

- Single-Frame Animation Controller eliminates the need for separate or computer plug-in animation controllers. Industry-standard protocols, make it compatible with most popular graphic and animation software packages.
- SMPTE Time Code Generator and Reader with Built-in Drop and Non-Drop Frame Read/Write is fully programmable from an external computer and resettable from the front panel.
- Video and Audio Switcher with Two independent Video and Audio Channels. Each video channel contains both composite and S-Video inputs. Each audio channel contains two linear and two Hi-Fi inputs Switching can be performed either manually, or under RS232 or RS422 control. Video and audio channels are switched independently letting you perform break-away edits.
- Auto-Sensing Single RS422/RS232 Input eliminates the need for optional external interfaces. Interface requirements are automatically sensed and adjusted within the recorder.
- Input and Playback Video Processing allows adjustments to the video level of the incoming signal. Signal levels and hue can be adjusted during playback.

BTS

Broadcast Television Systems

Betacam SP-2000 PRO Series

PBC 2600 Player

- Superior picture quality to any other professional system.
- Brings virtual Betacam SP quality within the budgets of professional users.
- More than 90 minutes of playback time using L-size Metal or Oxide cassettes.
- High-speed picture search provides recognizable color pictures at up to 10 times normal speed in forward and reverse (24 times normal speed in monochrome)
- Two longitudinal audio channels with Dolby C-type NR (Noise Reduction) system
- Equipped with RS-422 9-pin serial interface which is broadcast standard protocol.
- Built-in Time Base Corrector with advanced high quality digital dropout compensator
- Optional BVR-50 provides remote control of the PBC
- Built-in LTC/VITC/User Bits reader, and character generator
- User friendly dial menu operation, enhanced serviceability with built-in self diagnostics
- Y/R - Y/B-Y component signal outputs via BNC or 12-pin Betacam DUB connectors. Also has S-Video output.
- Optional BKW-2020 provides U-matic DUB output capability.

PBC 2650 Player with Dynamic Tracking (DT)

Same as PBC-2600 plus–

- Dynamic Tracking (DT) provides broadcast quality noiseless playback within -1 to +3 times normal speed

PBC 2800 Player/Recorder

Same as PBC-2600 plus–

- Built-in comprehensive editing facilities
- Dynamic Motion Control with memory provides slow motion editing capability (when used with a player VTR equipped with DT function)
- More than 90 minutes of recording/playback time using L-size Metal (for both recording and playback) or Oxide (for playback only) cassettes.
- Built-in LTC/VITC/User Bits generator and reader, also built-in character generator
- Y/R - Y/B-Y component signal inputs and outputs via BNC or 12-pin Betacam DUB connectors. Also has S-Video input and output.

SONY

PROFESSIONAL S-VHS SYSTEM

SVP-9000 S-VHS Player **SVO-9600 S-VHS Player/Recorder**

The SVP-9000 S-VHS player and SVO-9600 recorder are designed as multi-purpose machines with the use of various optical interface boards. By selecting one or more of a particular board, they become dedicated machines for satellite recording, office viewing, video library, sports analysis and editing. At the same time, they adhere to Sonys professional VTR concept of reliable mechanism, rigid construction and easy operation, ensuring reliable and reliable operation in the industrial and professional environment.

They both feature:

- Using the S-VHS format, they deliver superb picture playback and recording. With newly developed Digital Y/C separator maintained picture quality even in composite.
- Newly developed video cross talk canceller eliminates color blur providing more accurate color and sharper images.
- Four channel audio system – Two Hi-fi with a dynamic range of 90dB and two linear channels with Dolby NR.
- Two direct-drive reel motors provide rapid response and smooth operations. Mode transitions such as STOP to REC, FAST FWD to PLAY, STOP to REWIND are instantaneous.
- Picture search from -10 to +10 times normal speed
- SYNC IN for synchronizing with other video sources
- Automatic repeat and automatic rewind can be accomplished with programmed operation.
- There is a TIMER switch for either REC or PLAY (SVP-9000 PLAY only) when selected automatically executes the selected mode when the power is turned on. This is very useful for unattended operation such as satellite recording.
- Auto head cleaner – each time a cassette is loaded or ejected, a cleaning roller automatically passes over the video/FM audio heads removing tape residue and providing preventive care of the tape heads.
- The SVO-9600 features sensor recording. When video signals are input, it automatically starts recording.
- 19" EIA rack mountable plus adjustable front controls.

Optional Interface Cards:

- **SVBK-100** 33-pin interface board allows remote control of basic VTR functions.
- **SVBK-120** RS-232 interface board allows for machine control from a computer.
- **SVBK-140** RS-422 interface board allows either machine to be configured into any professional system.
- **SVBK-150** Digital Noise Reducer board reduces jitter, noise and Y/C delay and provides clear, crisp still frames.
- **SVBK-160** SMPTE Time Code interface board (can only be used with SVBK-140 board).

NEWTEK VIDEO TOASTER 4000

- Production Switcher
- Luminance Keyer
- Frame Grabber/Frame Store
- ChromaFX Color Processor
- Digital Video Effects
- Character Generator
- ToasterPaint
- Dual Frame Buffers/Genlock
- Lightwave 3D

NOVA SYSTEMS, INC.

NovaBlox

VIDEO PROCESSING SYSTEM

The NovaBlox Video Processing System is comprised of individual function modules called NovaCards. The range of NovaCard modules includes time base correctors, frame synchronizers, sync generators, encoders, decoders, transcoders, distribution amplifiers and routing switchers. NovaCards have the flexibility of plugging into either a computer or one of four NovaChassis that hold from one to 15 modules. NovaCards fit into an IBM or compatible expansion slot including Amiga. Most of the NovaCards utilize RS-232 serial date for operational control and include DOS, Windows, and Amiga software. For desktop and portable applications, the C-2B chassis hold two cards. There is also the C-4 single rackmount chassis that accommodates up to four NovaCards and the three rack C-15 NovaFrame, which features 15 slots. To provide operational control when using one of the NovaChassis there are two NovaTrol Serial Control Units to choose from. They provide LCD status display with four button operation or the NovaTrol/2 which has enhanced operation with dedicated function controls and LCD status display.

NOVAMATE TBC/Frame Synchronizer

One of the NovaCard modules of the NovaBlox system, the NovaMate is a unique TBC/Frame Synchronizer that satisfies a wide range of VCR signal correction and video interface requirements from desktop video to satellite systems. NovaMate plugs directly into a computer or one of several chassis configurations. Control is performed either by software or NovaTrol control units. The flexibility of its modular design and microprocessor control plus its superior quality make NovaMate the ideal alternative to stand-alone and computer based TBCs.

WE CARRY ALL OTHER NOVACARDS: ENCODERS, DECODERS, TRANSCODERS, DISTRIBUTION AMPLIFIERS AND ROUTING SWITCHERS

HORITA

BSG-50

Blackburst/Sync/Tone Generator

The BSG-50 provides an economical means for generating the most common RS-170A video timing signals used to operate various video switchers, effects generators, TBCs, VCRs, cameras and video edit controllers.

- 6 BNC video/pulse outputs
- Now available: 6 blackburst, 4 sync, 2 subcarrier
- Each sync output individually settable for composite sync, composite blanking, H-drive, or V-drive.
- Separate buffer for each output–maximum signal isolation
- 1KHz, 0dB sinewave audio tone output, locked to video
- Outputs can easily be configured to meet specific user and equipment needs $269

CSG-50

Color Bar/Sync/ Tone Generator

- Generates full/SMPTE color bars, blackburst and composite sync signals.
- Built-in timer can automatically switch video output from color bars to color black after 30 or 60 seconds. Easy and convenient for producing tape leaders and striping tapes with color bars and black.
- Front panel selection of full-field or SMPTE color bar patterns or colorblack (blackburst) video output.
- Includes crystal-controlled, 1KHz, 0dB audio tone output.
- Outputs: video, sync, ref frame, 1 KHz, 0dB
- Audio tone switches to silence and color bars change to black when using 30/60 second timer
- Fully RS-170A SC/H phased and always correct. No adjustment required $349

WE STOCK THE FULL LINE OF HORITA PRODUCTS INCLUDING:

WG-50 –	Window Dub Inserter
TG-50 –	Generator/Inserter
TRG-50 –	Generator/Inserter/Search Speed Reader
TRG-50PC –	Has all of the above plus RS-232 control.
VG-50 –	VITC Generator, LTC-VITC Translator
VLT-50 –	VITC-To-LTC Translator
VLT-50PC –	VITC-To-LTC Translator / RS-232 Control
RLT-50 –	Hi8 (EVO-9800/9850)TC to LTC Translator
TSG-50 –	NTSC Test Signal Generator
SCT-50 –	Serial Control Titler "Industrial" CG, Time-Date Stamp, Time Code Captioning
SAG-50 –	Safe Area, Convergence Pattern and Oscilloscope Line Trigger and Generator

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Fluid Heads & Tripods

The silky, smooth action of each Miller Fluid Head is the product of the finest quality cast and machined parts functioning together in a fluid environment. They are engineering masterpieces, built to operate even under extreme conditions. They are engineered to exceptionally fine tolerances and their mechanisms are protected effectively against ambient moisture and dust.

Miller 20 - Series II Fluid Head

- Continuously adjustable fluid drag control
- Sliding/Quick Release camera platform
- Weighs only 4 lbs. will handle cameras up to 22 lbs.
- Counterbalance system designed to compensate for nose heavy or tail heavy camera configurations, and permits fingertip control of the camera throughout the tilt range.
- Includes independent pan and tilt locks, bubble level, dual pan handle carriers and integrated 75mm ball levelling.

#440 - Lightweight Tripod

- Weighs only 4.5 lbs., supports up to 30 lbs.
- Minimum height down to 24", maximum height to 57".
- Extremely portable, folds down to 33"
- Engineered from thermoplastic moldings, diecast alloy and hard anodized tubular alloy.
- Fast one turn, captive leg locks
- Includes 75mm (3") ball levelling bowl

#420 - 2-Stage Tripod

- Two extension sections on each leg. Operates at low levels as well as normal heights without the use of mini legs.
- High torsional rigidity, no pan backlash
- Weighs 6.6lbs., supports 50 lbs.
- Very portable, folds to 27"
- Includes 75mm (3") ball levelling bowl with model 420 model 402 includes 100mm (4") ball levelling bowl.

System 20 Catalog #338

- Miller 20 II fluid head • 440 Lightweight tripod
- 410 tripod spreader with foot pads 1549.00

System 20 ENG Cat. #339

- Miller 20 II fluid head • 420 2-stage tripod
- 410 tripod spreader with foot pads 1895.00

Vinten

Vision SD 12 and SD 22

Pan and Tilt Heads with Serial Drag

The Vision SD 12 and SD 22 are the first heads with the "Serial Drag" pan and tilt system. The system consists of a unique, permanently-sealed fluid drag and an advanced lubricated friction drag. So for the first time, one head gives you all the advantages of both fluid (viscous) and lubricated (LF) drag systems – and none of their disadvantages. Achieve the smoothest pans and tilts regardless of speed, drag setting and ambient temperature.

- Simple, easy-to-use external control for perfect balance.
- Patented spring-assisted counter-balance system permits perfect "hands-off" camera balance over full 180° of tilt.
- Instant drag system breakaway and recovery overcome inertia and friction for excellent "whip pans".
- Consistent drag levels in both pan and tilt axis
- Flick on, flick off pan and tilt caliper disc brakes.
- Greater control, precision, flexibility and "touch" than any other head on the market.
- Touch activated, time delayed illuminated level bubble.
- Working conditions from as low as -40° up to +60°C
- SD 12 weighs 6.6 lbs and supports up to 35 lbs.
- SD 22 weighs 12.7 lbs and supports up to 55 lbs.

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

The ultimate in lightweight and innovative tripods, they are available with durable tubular alloy (Model #3513) or the stronger and lighter, axially and spirally wound carbon fiber construction (Model #3523). They incorporate torque safe clamps to provide fast, safe and self-adjusting leg clamps.

- "Torque Safe" requires no adjustment. Its unique design adjusts itself as and when required, eliminating the need for manual adjustment and maintenance and making for a much more reliable clamping system.
- New hip joint eliminates play and adds rigidity.
- They both feature 100mm levelling bowl, fold down to a compact 28", and support 45 lbs.
- The #3513 weighs 6.5 lbs and the #3523 CF (Carbon Fibre) weighs 5.2 lbs.

Vision 12 Systems

All Vision 12 systems include #3643 SD 12 dual fluid and lubricated friction drag pan/tilt head, single telescoping pan bar and clamp with 100mm ball base.

SD-12A System

- 3364-3 SD-12 Pan and tilt head
- 3518-3 Single stage ENG tripod with 100mm bowl
- 3363-3 Lightweight calibrated floor spreader

SD-12D System

- 3364-3 SD-12 Pan and tilt head
- 3513-3 Two-stage ENG tripod with 100mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

Vision 22 Systems

All Vision 22 systems include #3386-3 SD-22 dual fluid and lubricated friction drag pan and tilt head, single telescoping pan and clamp with dual 100mm/150mm ball base.

SD-22E System

- 3386-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3516-3 Two-stage EFP tripod with 150mm bowl.
- 3314-3 Heavy-duty calibrated floor spreader

SONY

EVW-300

Hi-8 3-CCD CAMCORDER

The EVW-300 is a complete one piece camcorder which includes a variety of innovative and advanced operational features. So, whether your shoots require basic recording capabilities or premier performance, the EVW-300 offers a wide range of features and remarkable recording quality to best suit your needs.

Features:

- Equipped with three high density 1/2" IT Hyper HAD image sensors. Has an excellent sensitivity of F8.0 at 2,000 lux, high S/N of 60 dB, and delivers over 700 lines of horizontal resolution.
- Provides high quality PCM digital stereo and single channel AFM Hi-Fi recording. Has XLR balanced audio connectors.
- Quick start 1.5" viewfinder with 550 lines of resolution plus Zebra pattern video level indicator and color bar generator
- Quick-start recording – takes only 0.5 seconds to go from REC PAUSE to REC MODE for immediate recording in the field
- Built-in 8mm Time Code generator records absolute addresses. (Either non-drop frame or drop frame mode may be selected.) Furthermore the EVW-300 incorporates a variety of time code features such as Time Code PRESET/RESET, REC RUN/FREE RUN and User Bits.
- Variety of automatic adjustment functions for different lighting conditions. **ATW (Auto Trace White Balance)** – optimum white balance is always ensured during recording, even for changes in color temperature. Conventional white balance adjustment is still provided with the Auto White Balance. **AGC (Automatic Gain Control)** – in addition to manual Gain Up AGC provides linear gain up in the range of 0 dB to 18 dB. **Intelligent Auto Iris** – where the lighting between subject and background is different (subject is underexposed) the Intelligent Auto Iris automatically adjusts the lens iris for proper exposure.
- Selectable Gain-up from 1 dB to 18 dB in 1 dB steps for Mid & High positions
- Clear Scan function – provides a variety of selection of shutter speeds ranging from 60-200 Hz allowing recording of almost any computer display without flicker.
- Compact, lightweight (12 lbs with NP-1B) ergonomic design provides well balanced and extremely comfortable operation.

TOSHIBA

TSC-200

3-CCD Hi-8 Camcorder

- 3 ½" CCD chips mounted with spatial offset technology deliver resolution of 700 horizontal lines
- Low noise design provides extreme sensitivity of F8.0 at 2000 lux. Min. illumination 7.5 lux with excellent color reproduction
- New LNA (low noise amplifier) delivers a S/N (signal-to-noise) ratio of 62dB - the highest achieved for this type of camera
- 26-pin connector outputs Y/C or component video signal allowing hook up to a portable S-VHS, MII or Betacam recorder and simultaneously record with Hi-8.
- Quick-start 1.5" viewfinder needs no warm up time so you never miss a shot. Zebra pattern in the viewfinder alerts operator to excessive video levels.
- Genlock capability allows synchronization with other cameras. Also full calibration functions are built-in as well as color bar generator.
- Variable high speed shutter from 1/60 to 1/2000 second
- Built-in 8mm time code generator records an absolute address to every frame.
- High-performance back electret condenser mic records to all three audio tracks. Low cut filter eliminates wind noise.
- Very low power consumption. Draws only 16 watts per hour allowing 100 minutes of recording time with 1 NP-1B battery.
- Body made of magnesium alloy previously found only on broadcast cameras. Still only 13 lbs. in standard configuration.

JVC GY-X2

3-CCD S-VHS CAMCORDER

- Three 1/2" CCD image sensor delivers 650 lines of horizontal resolution
- New micro-lens technology provides exceptional sensitivity of F7.0 at 2000 lux and new LOLUX mode lets you shoot with almost no light! Now you can shoot superb footage with excellent color balanced at a mere 3 lux illumination
- Variable Scan View allows flicker-free shooting of a computer monitor.
- Quick Record Mode - when turned on the camera is set to the auto iris even if lens is set at manual. Also activated is (ALC) Automatic Level Control and EEI Extended Electronic Iris which provides both variable gain and variable shutter. Now you can shoot continuously from dark room to bright outdoors without having to adjust gain, iris or ND filter.
- Full Time Auto White circuit lets you move from incandescent to fluorescent to outdoor lighting without changing white balance or the filter wheel.
- Genlock input allow synchronization with other cameras.
- Dual output system allows camera output to be connected directly to an external recorder

KY-27UB

3-CCD Color Video Camera

- New ½" CCDs with 380,000 pixels (360,000 effective) with advanced electronics delivers resolution of 750 horizontal lines and reduced smear.
- Special low reflection membrane for CCD shielding screen greatly reduces smear while minimizing light leakage.
- Sensitivity of f/8.0 at 2000 lux. Min. illumination 7.5 lux with f/1.4 lens, +18dB.
- LOLUX mode allows shooting scenes that were previously impossible due to insufficient lighting. CCDs are maximized for low light sensitivity equivalent to an electronic gain of 24dB plus a JVC pixel readout system which provides an additional 6dB. Together they provide +30dB without the noise and picture degradation normally associated with this much gain. Excellent color balance is maintained even down to 1.5 lux illumination.
- Auto Shooting Mode where you only have to zoom, focus and record. All other parameters are controlled automatically
- Enhanced ALC (Automatic Level Control) mode for continuous shooting in all light levels. This allows continuous automatic shooting from dark interiors to bright outdoors. Also features an aperture priority mode. Manually set iris for desired depth of focus, and ALC circuit automatically achieves correct video level.
- The Multi-Zone Iris Weighting system gives preference to objects in the center and lower portions of the picture. The Automatic Peak/Average Detection (APB) provides intelligence to ignore unusual objects such as bright lights.
- Auto knee circuitry extends a scene's light to dark dynamic range reproduction by up to five times without overexposure
- Has large 1.5-inch viewfinder with 500 lines of resolution and SMPTE color bars. Status system provides audio levels, accumulated or remaining recording time and VTR operation. Also battery voltage and camera setup. Zebra pattern indication and safety zones with a center marker are also provided.
- Equipped with Variable Scan function. This allows flicker-free shooting of computer screens. Variable scan enables a precise shutter speed from 160.2 to 1/96.7 of a second in 256 increments to be set, matching a computers scan rate. Almost any computer display can be clearly recorded.
- Star filter creates dramatic 4-point star effects. Users can also select from a wide range of optional filters.
- Advanced Memory System (AMS) stores customizable settings for various shooting conditions.
- Camera head is designed for durability and light weight. Provides excellent resistance to vibration and impact, for enhanced reliability. Overall balance is perfect with all controls optimally located for ease of use.
- Uses just 12.4 watts of power with camera adapter and viewfinder, so battery time can be allocated to VTR operation.
- Easily adjustable pedestal and detail enhancement through the Camera Setup Menu.
- Docks directly to the JVC BR-S422U. BR-S411UB and BR-S420CU professional S-VHS recorders. Optional adapters available for other models

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- Carry it in crowds – crush proof aluminum guard protects viewfinder.
- Fits into back seat and fastens securely with seat belt.
- Holds camera with on-board battery attached.
- Lid closes with Velcro for quick-opening or secure with full-length zippers.
- Two trim exterior pockets and clip board pocket.
- Dual purpose rear pouch is an expandable battery chamber or all-purpose pocket.

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  Run time: 2 hours @ 27 watts, 3 hrs. @ 18 watts
- **DIGITAL PRO PAC 13 LOGIC SERIES NICAD BATTERY**
  13.2v 55 Watt Hours. 4 3/4 lbs.
  Run time: 2 hours @ 25 watts, 3 hours @ 17 watts

DIGITAL MAGNUM COMPACS

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- **DIGITAL COMPAC MAGNUM 14 LOGIC SERIES NICAD BATTERY**
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- **DIGITAL COMPAC MAGNUM 13 LOGIC SERIES NICAD BATTERY**
  13.2v 40 Watt Hours. 2 1/2 lbs.
  Run time: 2 hours @ 18 watts, 3 hours @ 12 watts.

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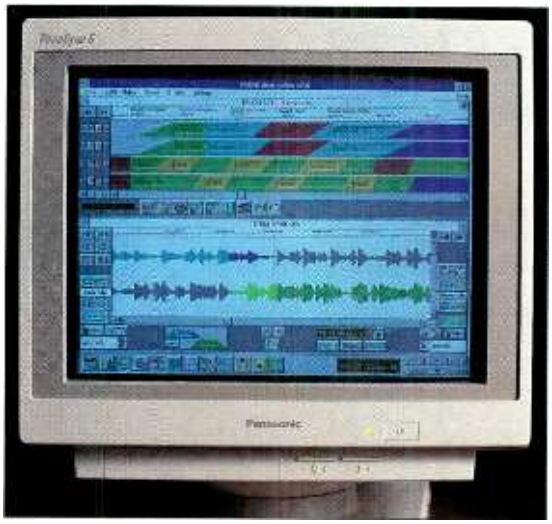

Studio Audio and Video SADiE

By Ian Britton

Metro Radio operates a group of commercial radio stations in northern England. The company's commercial production department has as its core business the production of effective radio advertising for the stations' clients.

In the fall of 1993, the department was planning an upgrade of its 8-track analog system when we encountered Studio Audio and Video's SADiE at an exhibition. This caused us to change our minds about the direction of the upgrade. Three months later, a SADiE system was installed, and we have never looked back.

Setup and operation

SADiE is a PC-based digital audio disk editor, using a 486 computer running under DOS 6 and Windows 3.1. A turnkey system includes the PC, SADiE software, a digital audio processing card, an analog converter/time-code card, 1.2GB SCSI drive for storing audio data and a breakout box. The system has two inputs and four outputs, all available in S/PDIF, AES/EBU and analog formats. Up to eight tracks can be played simultaneously. Interconnections to the rest of the studio are straightforward using the breakout box that is supplied.

The system's operating instructions are clear and concise, which meant that by the end of day one we were making commercials on the system. It was always our intention to attend a SADiE training course after the first month, but we found the system so easy to use that in the end we didn't bother. The system was clearly designed by sound engineers who have made it operate in an intuitive way.

Performance at a glance:

- *A fast and user-friendly disk-based digital audio workstation*
- *Operates on IBM-compatible PCs in Windows 3.1 environment*
- *Eight-track system with mixing and powerful audio processing*
- *Screen displays and design philosophy keep learning curve short*
- *Appropriate for radio and TV production applications*
- *Can be outfitted with removable SCSI drives for efficient accommodation of multiple ongoing projects*

The author at work on SADiE, in the Metro Radio Group's production studio in Newcastle, England.

You record into SADiE just like any tape machine except you give each recording a name and then the computer automatically allocates take numbers. Once audio is in the system, you can work on it as if it's in a word processor: cut, copy, paste, change the EQ, slow it down, compress it, even play it backward. It really is that simple. All editing is non-destructive, so at any time you can start a job again. The audio is actually stored on a SCSI drive that holds up to two hours of stereo, or four hours of mono audio (on the basic system costing $9,995). At Metro Radio, we have since added another SCSI drive to increase our storage to five hours stereo or 10 hours mono.

Real-world advantages

In this facility, SADiE has been used exclusively for producing radio commercials. It has been standard practice for us to record one basic commercial with 17 different inserts or tags, to run on 17 different stations. On an 8-track tape system, this involved a few hours work. On SADiE the same job can be completed in less than half the time. On more complex jobs SADiE can save even more time.

Another common discipline in commercial production is making ads with precise, standard running lengths (typically in increments of 10 seconds). Working on a multitrack tape system, it could take 20 minutes to lay all the sound for a 40-second spot, only to discover it was two seconds short. Another 20 minutes of work

Britton is production manager at Metro Radio Group PLC, Newcastle, England. Respond via the *BE* FAXback line at 913-967-1905.

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followed to re-lay everything. With SADiE it only takes 10 minutes to lay all the sound, and if it comes up short, it's just a minute's work with the mouse to re-space everything.

SADiE also will allow you to mix the sound using faders on the screen. There is even automation on the faders so you can build up a complex mix and then store it for later use. Alternatively, it is possible to mix down internally to one stereo pair.

The system allows great flexibility in editing announcer tracks to correct errors or piece together the perfect take. The same can be done for music beds. By placing multiple versions of a bed into SADiE, you can cut any version you want. You can also perform some beautiful music edits. For example, I recently turned out a 30-second, 40-second and 50-second version of Mozart's "Marriage of Figaro." SADiE has had such a positive effect on our productivity we now handle the complete production load for two radio stations. This amounts to an average of 100 finished commercials a week.

After eight months of constant use, we are pleased to report that we have had no problems.

In another recent case, a client called and asked for her 30-second ad to be recut to 20 seconds. Fifteen minutes later the job was done. Her boss then changed his mind, so we cut it yet another way instead. Eventually, the client was delighted with the end product — so much so that a bottle of champagne arrived on our doorstep the next day.

SADiE has other features that we never have occasion to use but perhaps some would find useful. For instance, you can use SADiE to help in the production of CD-R discs. You load all the audio into the system, add the cues and the system will speak directly to a CD-R recorder, automatically placing all the cues appropriately. You can also do all the preparation work for the master of a standard, mass-produced CD.

Reliability

When we decided to invest in a SADiE system, one area of concern was how reliable it was going to be. Stories abound on other hard disk editors crashing in the middle of a session. If SADiE were to crash at anytime, it would have an unacceptable impact on the running of the studio. Clients would lose faith and the facility's image would suffer. After eight months of constant use we are pleased to report that we have had no problems. The system has even survived power outages with no ill effects.

Since Metro Radio has invested in SADiE, two other production companies have visited the station to see the system in operation. In both cases they have gone out and bought one.

By now you will have gathered that staff members at this operation are fans of the SADiE system, and all of its benefits. You need to get your hands on one to fully appreciate all it could do for your business. The management at Metro Radio will tell you that SADiE's biggest impact has been on the bottom line. The system has made us a smarter operation, allowing us to offer a better service to our clients while at the same time becoming more profitable. ■

See "Radio SADiE" on page 98

Editor's note: Field Reports are an exclusive *BE* feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting company. These reports are performed by the industry and for the industry. Manufacturer's support is limited to providing loan equipment, and to aiding the author if requested.
It is the responsibility of *Broadcast Engineering* to publish the results of any device tested, positive or negative. No report should be considered an endorsement or disapproval by *Broadcast Engineering* magazine.

For more information on Studio Audio and Video's SADiE, circle (338) on Reply Card.

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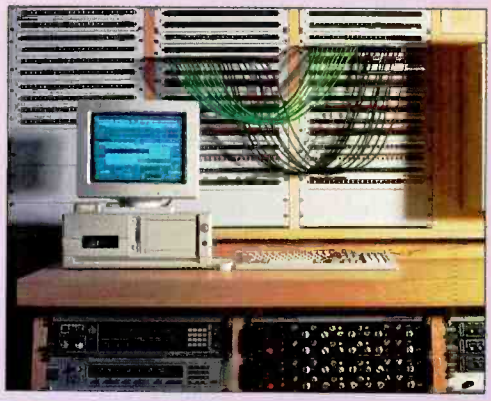
Radio SADiE

By Richard Dean

The installation of 24 SADiE systems at the BBC's Network Radio facility in Bristol, southwest England, has done more than save time and tape costs. It has turned an ardent sticky-tape and razor-blade man into an almost evangelically zealous technological convert.

Ian Bell, senior history and travel producer for BBC Radio 4 features department, admits to having harbored a strong skepticism toward computer-based editing techniques before the radio network installed its first SADiE last summer. By fall, he was convinced.

So how does an old-style 1/4-inch producer get along without a trusty edit block? The first step is to log raw material recorded on DAT and load it into the disk editor. The next step is to go through the footage and make the edit decisions. This is where the digital workstation approach really scores over traditional methods. Not only are individual actions reversible — there are 25 layers of undo on the latest software release — but the original remains intact.



SADiE in a studio at the BBC's network radio production facility in Bristol, England. This is one of 24 SADiE systems now in use at that facility.

Because SADiE operates in a Microsoft Windows environment, other applications can share the screen. When Bell is working on presenter links or the instructions for ambiences or music, he likes to run a word processor (in this case WordPerfect) on the lower half of the screen. This allows him to time scripts while keeping an eye on the progress of existing tracks in the upper window.

Dean is chief correspondent, Europe for *World Broadcast News*. Respond via the *BE* FAXback line at 913-967-1905.

Applications abound

At BBC's Pebble Mill facility, where much of the network's radio drama originates, all six SADiE systems have removable SCSI drives. This enables all original recordings to be transferred to studio post-production systems, where engineers can immediately add music and effects without having to load edited DAT material onto disk first.

Another advantage of this "transportable media" approach is that any errors in existing work can be corrected in its native format. By opening up a SADiE *Processor* window, the operator offers a console's worth of digital signal processing functions, available to each channel, and all performed in real-time. Like most other parameters, these are set with the mouse, and can be saved to disk for reuse on other material. All major input/output signal standards and digital sampling rates also are supported, plus analog I/O and SMPTE or MIDI time code.

The secret to SADiE's speed is that the audio is processed through a custom-designed internal card (which appears in a number of OEM products including the Lightworks video editing system), leaving the 486 host computer to concentrate on remembering edit decision lists and supporting screen graphics.

"When I started at Birmingham in 1979, I thought my Uher portable ATR and typewriter were the ultimate tools of the trade," Bell recalls fondly. "I have since concluded — if reluctantly at first — that however good you are with a razor, there are some SADiE edits that are simply not possible any other way."

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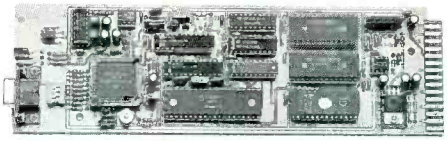

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BE FAXback survey

***Broadcast Engineering* magazine is always interested in what readers want to know. You can help us in planning our coverage of industry issues by completing this questionnaire.**

Please complete the following questions and mail or fax it back by Aug. 1. (Fax 913-967-1905) (Mail to *Broadcast Engineering* magazine, 9800 Metcalf, Overland Park, KS 66212-2215)

Name _____

Title _____

Address _____

State, zip _____

Telephone number (optional) _____ **Fax # (optional)** _____

(Respondents who provide their telephone number may be called by *BE* editors so we can better understand your concern.)

Type of facility: Radio ____ TV ___ Post-Production ___ Other (describe) _____
Market ADI _____

Please answer those questions pertaining to your type of facility, as well as the common-issue questions.

Common issues:

(All respondents should answer these questions.)

1) Describe one area of technology you need to know more about. _____
2) Do you use any electronic communication service? (CompuServe, Prodigy, America On-Line, Internet)
   Yes ___ No ___ What service do you use? _____
   How often? Daily ___ Weekly ___ Once or more per month ___
3) Do you have CD-ROM capability? Yes ___ No ___
4) Would you use the *BE* BBS to provide feedback to our editors and for other purposes? Yes ___ No ___
5) What kinds of articles would you like to see more of? _____
   _____

TV facility questions:

1) Is your facility planning now to implement HDTV? Yes ___ No ___
   If so, when will you first make a purchase? _____
2) Is your facility planning on implementing any non-HDTV 16:9 production capability? Yes ___ No ___
3) Does your facility have non-linear editing capability? Yes ___ No ___
   If not, when do you plan to add that capability? _____
   If yes, what brand of editor are you using? _____ How many do you have? _____
4) What primary use in your facility do you see for video servers? _____
   _____
5) What percent of your equipment/facility is digital? Audio ___ Video ___
   How long will it be until your facility is 90% digital? _____

Radio facility questions:

1) Is your station planning now to implement RBDS? Yes ___ No ___
   If yes, when will you first make an RBDS equipment purchase? _____
2) Is your station automated? Yes ___ No ___ If yes, what dayparts? _____
3) Concerning cart replacement, do you favor a digital cart machine or a PC-based hard disk/file server? _____
4) Does your station have a digital audio workstation? Yes ___ No ___
   If no, do you plan to purchase one? Yes ___ No ___ When? _____
5) Does your station use switched 56 or ISDN services? Yes ___ No ___
   If so, for what purposes? _____
6) Are you involved in an LMA or duopoly-type arrangement? Yes ___ No ___
   If so, how would you describe the results of that arrangement so far? _____
7) What types of radio technology do you need to know more about? _____

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EDITOR - VIDEO SYSTEMS, the leading professional video magazine, has an excellent opportunity for the EDITOR to plan, develop and implement editorial content and oversee production of monthly publication. Will represent magazine as speaker and attendee at trade shows and serve on committees of industry associations. The successful candidate will have five years+ managerial exp. in publishing, professional video or a related field. A bachelor's degree in Journalism, Radio/TV, Engineering/Electronics or a related field is required. Please send resume and salary requirements to: Intertec Publishing, Human Resources Dept. EVS, P.O. Box 12901, OP, KS, 66282-2901.

TRANSMITTER/STUDIO ENGINEER needed for top 40 market UHF-TV station. SBE Certification desirable. Experience maintaining UHF full power transmitters required. Knowledge of Type "C", Betacam SP, and U-Matic videotape maintenance also desired. Full time position, EOE. If interested please send (or FAX [804] 399-3303) resume to WGNT-TV Channel 27, Attention: George Randell, 1318 Spratley Street, Portsmouth, VA 23704.

MAINTENANCE TECHNICIAN: Familiar with installation, maintenance, and operations of all types of TV Broadcast Equipment. Prior experience with TV Broadcast Equipment required. FCC license required. Send resume to: WXEL PERSONNEL DEPT., P.O. Box 6607, West Palm Beach, FL 33405. NO PHONE CALLS PLEASE!! WXEL is an EOE, M/F/H.

CHIEF ENGINEER: Min. 5+ years broadcast experience. Familiar with scheduling, operations, installation, and maintenance of equipment for TV station including transmitter. FCC General Class & SBE Certification License required. Send resume to: WXEL PERSONNEL DEPT., P.O. Box 6607, West Palm Beach, FL 33405. NO PHONE CALLS PLEASE!! WXEL is an EOE, M/F/H.

MASTER CONTROL OPERATOR: Min. 5 years Exp. & FCC License Required. Send Resume to: KRCA-TV CH62, 1813 Victory Pl., Burbank, CA 91504. An Equal Opportunity Employer..

CHIEF ENGINEER - Become part of a team that is developing an amazing News and Technology environment. Located in the Washington, DC area, it will include a digital broadcast studio, a HD theater and multimedia interactive displays. Must have 10 years experience in broadcast engineering and computers. Please fax resume to The Freedom Forum 703-284-3509 or send to: Director of Human Resources, The Freedom Forum, 1101 Wilson Blvd., Arlington, VA 22209, no phone calls please, EOE..

MAINTENANCE ENGINEER opening at Century III at Universal Studios, Orlando, FL. Large post facility loaded with state of the art equipment. Must be capable of troubleshooting studio equipment to the component level. Experience in maintaining digital and microprocessor-based equipment required. Send resume to: 2000 Universal Studios Plaza, Orlando, FL 32819. Attn: David Wilson, or fax 407-352-8662.

ENGINEER WANTED: Northern Ontario company looking for a full-time engineer to maintain 2 A.M. radio stations. Experience with both transmitters and studios required. For more details contact our retiring engineer, Bob White. (705) 647-7334.

SMALL TV STATION with high standards and excellent equipment needs a hands-on type chief engineer. Maintenance skills essential for this position. Good benefits and good salary. We are an EEO employer. Please send resume to: Broadcast Engineering, Dept. 743, P.O. Box 12901, Overland Park, KS 66282-2901.

ASSISTANT VICE PRESIDENT ENGINEERING: SCETV is seeking someone to assist the Vice President in the planning, design, construction, operation, and maintenance of technical facilities used in the production and transmission of television and radio programs. This includes television studio facilities, recording and post production facilities, master control, television and radio transmitter facilities, satellite uplink and downlink facilities, microwave systems, ITFS transmitting and reception systems, fiber optic systems, building distribution systems. Must be a Registered Professional Engineer in South Carolina and have a Commercial Radio Operators License from the Federal Communications Commission. Must have a BS degree in engineering and eight (8) years experience or equivalent training and experience in the design and construction of: television and radio transmitting facilities, satellite earth terminals, television and radio studio facilities, microwave transmission systems, fiber optic systems, digital systems and the architecture of computers and computer systems. Must be qualified and experienced in the use of computer programming for engineering purposes. EOE. SALARY RANGE: $39,254-$58,882. 40 HOURS PER WEEK, POSITION #: 119768. For More Information Contact: Ethel Brown, Personnel Assistant, (803) 737-3457.

KMGH TV is seeking a Maintenance Engineer. Must have 5 years experience in a TV station maintenance situation, component level troubleshooting skills, Associates degree in Electronics, and FCC General class license. Good interpersonal skills, and ability to work well under pressure needed. Must be willing to work nights and weekends. Send or Fax resume to KMGH TV, Attn: Ron Hays, 123 Speer Blvd., Denver, CO 80203. Fax: 303-861-5694.

WANTED: Asssistant Chief Engineer. Requires strong management and technical skills. Experience, 10 years in television, 3 years in a management position. Send resume to: KLAS TV, P.O. Box 15047, Las Vegas, NV 89109. Attn: Management. NO CALLS PLEASE.

TRI-STATE CHRISTIAN TV has chief engineer openings in different locations. Must possess good basic electronic skills. Experience in broadcasting helpful but not required. Send resume to P.O. Box 1010; Marion, Illinois; 62959. An EEO employer.

FULL TIME INSTRUCTIONAL TELEVISION TECHNICIAN at Wisconsin Indianhead Technical College - Rice Lake, WI. Candidates must have two years of post-secondary education in electronics; two years of full-time work experience in audio-visual services, microwave, and/or television studio engineering field; or one year post-secondary education and four years full-time work experience. WITC Office and Technical Support application must be postmarked by July 8, 1994. Contact: Educational Services Assistant, WITC Rice Lake, 715/234-7082. TDD #715/468-7755. AN EQUAL OPPORTUNITY EMPLOYER.

CHIEF ENGINEER, Las Vegas, NV. New 24-hour cable channel needs a chief and assistant knowledgeable in video cart and disk based recording, "C" band uplinks, fiber optics, Abekas and general broadcast equipment. Chief will be responsible for design, construction, maintenance and training in this state of the art facility. Please mail resume to: Robert Porter, 4009 Rand Ct., Sherman Oaks, CA 91423-4704. Fax 818-986-3979.

MAINTENANCE TECHNICIAN for studio/transmitter. Experienced in Sony Beta Cart, Beta SP Players, as well as 1" VTRs. Other equipment includes GVG 1600's, GVG 300, Sony BVE 5000 editor and Harris TVE 120S transmitter. Send resume and salary requirements to Chief Engineer, WGBS-TV, 420 North 20th Street, Phila, PA 19130 or Fax to (215) 563-5786. No phone calls please. M/F EOE.

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As a software developer on our Broadcast products team, you will finalize architecture, design, code and test features. AirPlay, Avid's disk-based playback system for broadcast television, incorporates video compression, disk-array and high-speed networking technology with an easy-to-use Macintosh interface. NewsCutter, Avid's digital nonlinear editing system for news applications, gives you instant random access to material stored on high-speed disks, with built-in tools for titling and transition effects. Bachelor's degree in Computer Science or equivalent, with a minimum of 5 years' related experience is required. Strong C programming skills; C++ experience highly desirable. **Dept. BSE**

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AMERICA AND UK/EUROPE

The Australian Broadcasting Corporation is looking for two D-CART Customer Service Engineer/Managers, one for the Americas (based in New York) and one for United Kingdom/Europe region (based in London).

D-CART is the revolutionary multi-user audio system pioneered by the ABC. This leading edge technology is now being used by the world's largest broadcasters. Development work is continuing to expand D-CART into other industries and applications including a fully digital on-air audio mixer.

The success of D-CART in the Americas and UK/Europe has created a need for locally based Customer Service Engineers who will provide local and regional technical support for current and future customers in America, Canada, Mexico (New York position); and UK/Europe (London based position).

You will:

- Be responsible for all customer D-Cart support issues within the Americas/European region.
- Develop and direct appropriate programs and procedures for the maintenance, planning, installation, commissioning, and technical operations for the D-CART customers in the Americas/Europe.
- Ensure the prescribed D-CART technical standards are met efficiently and effectively.
- Oversee and/or perform planning, maintenance, installation, and/or commissioning duties for D-CART in the Americas/Europe.
- Liaise and consult with ABC D-CART Marketing, the Technical Research and Development staff, marketing partners, and external customers as required.
- Perform appropriate duties in other areas connected with support of ABC Digital systems as required.
- Apply corporate EEO policies.

It is expected that you will have extensive experience (5 years +) in digital audio systems including the planning, installation, maintenance, and technical operation of both hardware and software components of similar broadcast and/or audio systems.

You will also have a high level of communication skills and demonstrated abilities in the administration of service personal and software and hardware management.

As well as being suitably qualified, the ability to speak a second language appropriate to the region would be desirable.

This position will be on a contract basis to the Australian Broadcasting Corporation for an initial period of six months, with options to renew. Salary is negotiable and determined by qualifications and the specific terms of the contract.

Initial enquiries should be directed to Reem Saad on +612 333 2209 Australia or by fax to +612 333 1413. Applications quoting Reference Number ZNR41936/37 should be sent to the Employment Officer-Southside, ABC, GPO Box 9994, Sydney NSW 2001 Australia or by fax to +612 333 3444. Applications close 1.7.94.

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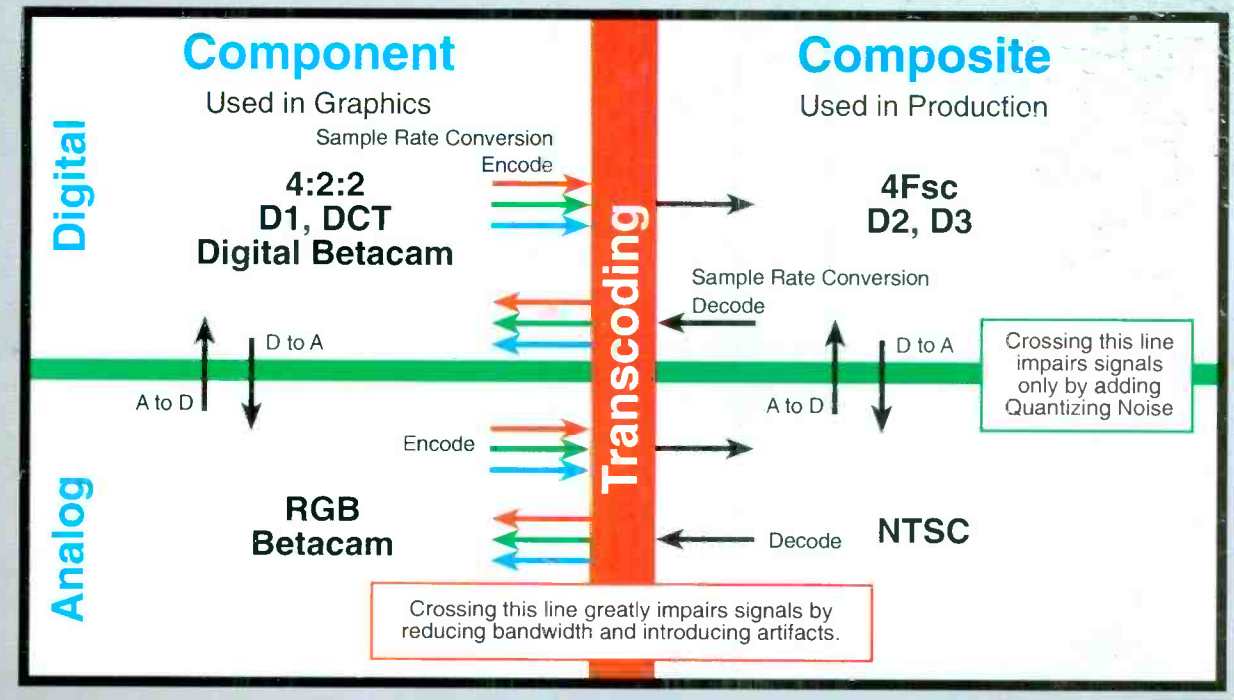

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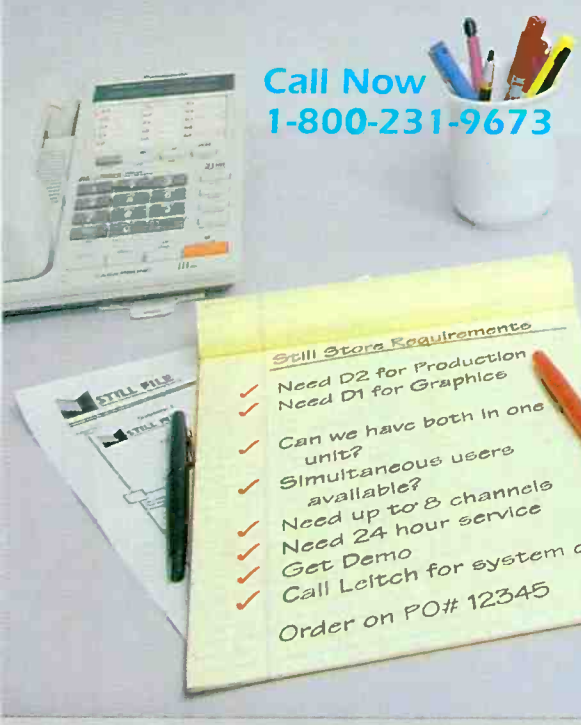

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