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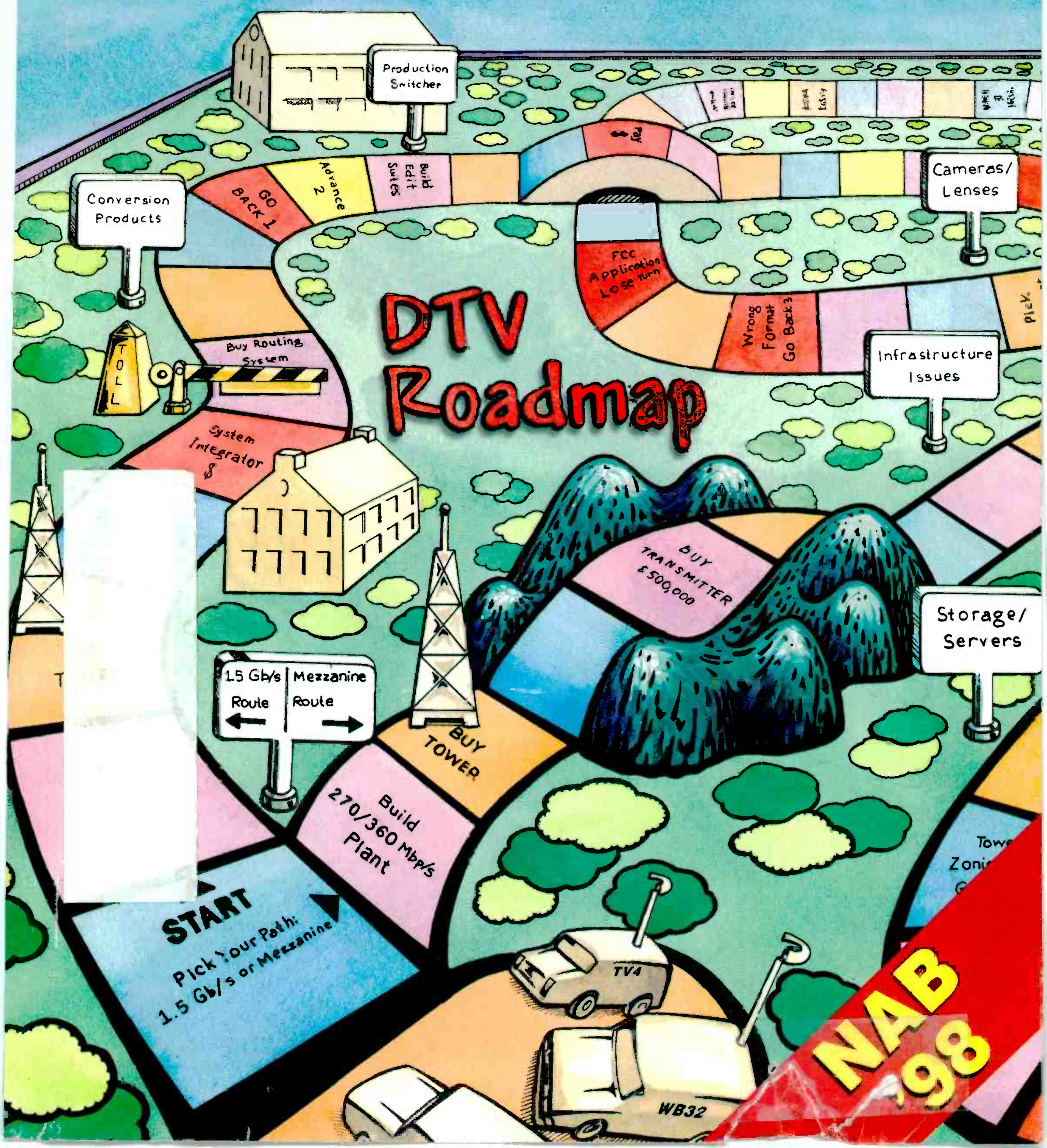
MARCH 1998

Broadcast ENGINEERING®

THE JOURNAL OF DIGITAL TELEVISION™



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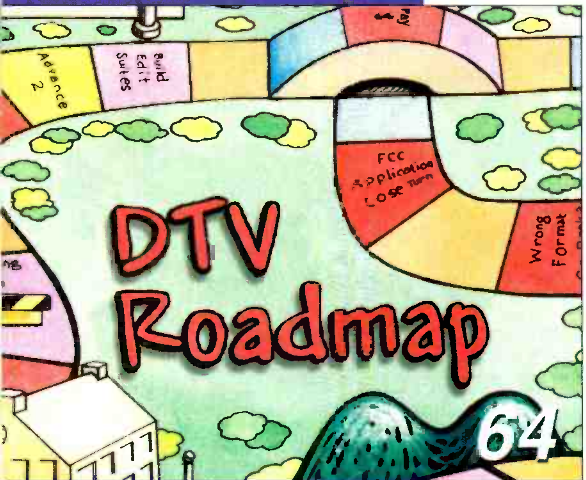
DVCPRO 50

March 1998
Volume 40
Number 3

Broadcast ENGINEERING
THE JOURNAL OF DIGITAL TELEVISION

IN THIS ISSUE



Features

Beyond the Headlines

Digital Handbook

(Continued on page 8)

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ON THE COVER: *Building digital facilities is a step-by-step project. The cover illustrates the concept of a two-path approach to going digital straight to HD with a 1.5Gb/s system, or the mezzanine solution at 270/360Mb/s. Let our experts and vendors help you make the right choice. Cover design by Steve Bonham.*

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FREEZE FRAME

A look at the technology that shaped this industry.

Do you remember?

What made the 1978 NAB convention location unique?

Answer: It marked the first time NAB was held in Las Vegas, NV.

Plethora of products

This year's NAB is sure to be a plethora of products. Yep, a bounty of boxes, a ton of technology, a marketplace of miracles, a forum for the future. Well, you get the picture!

Although last year's show was so hot, and everyone got burned and ended up afraid to do anything, that won't be the case next month. A short survey by our news writer showed, as he put it, "The checkbooks are open." Stations are in a buying mood and that's good.

It's about time we got on with the DTV conversion process. For a few good and a lot of not-so-good reasons, stations have delayed making the investment in their futures. I know some hoped that DTV would never make the light of day, but it's here now, so let's profit from it.

Since January's CES show, I have sensed a building intensity, an anticipation for the NAB convention. Readers tell me they want to get to the show, not just to look, but to buy the products they'll need to convert to digital. What fun it must be to know you're on the ground floor of this monumental industry shift. From analog to digital, a transition that's, in our industry's time frame, going to happen in the blink of an eye. What wonderful excitement to know you're in at the beginning, to be a part of history. I've talked to engineers who were there when color was first introduced. Sure, they speak of the problems, but they also talk of the adventure, the spirit of challenge and experimentation they felt.

So, as I write this in the middle of February, I'm still wondering what new and exciting technology will grace the show floor. As the convention grows ever larger and the crowds increase, the challenge for me and my staff will be to help you make the right decisions for your station or production house. We'll be there, some 100 strong, spread over six magazines, all just as excited as you are about the changes in our industry.

Stop by one of our booths, renew your subscription or talk to a member of our staff. We'll be glad to see you. And, for you techno geeks, check out our NAB Electronic Daily at **www.broadcastengineering.com**. We will have a full-time staff on-site bringing you the latest news and products from the show floor and off-site press conferences. If you left your laptop at home, don't worry. The site will be on-line for months to come, so be sure and check it out.

In the meantime, don't forget to write. Our address is shown below.

Brad Dick

Brad Dick, editor

direct: brad_dick@compuserve.com
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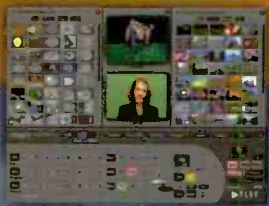

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NAB Booth S 2918

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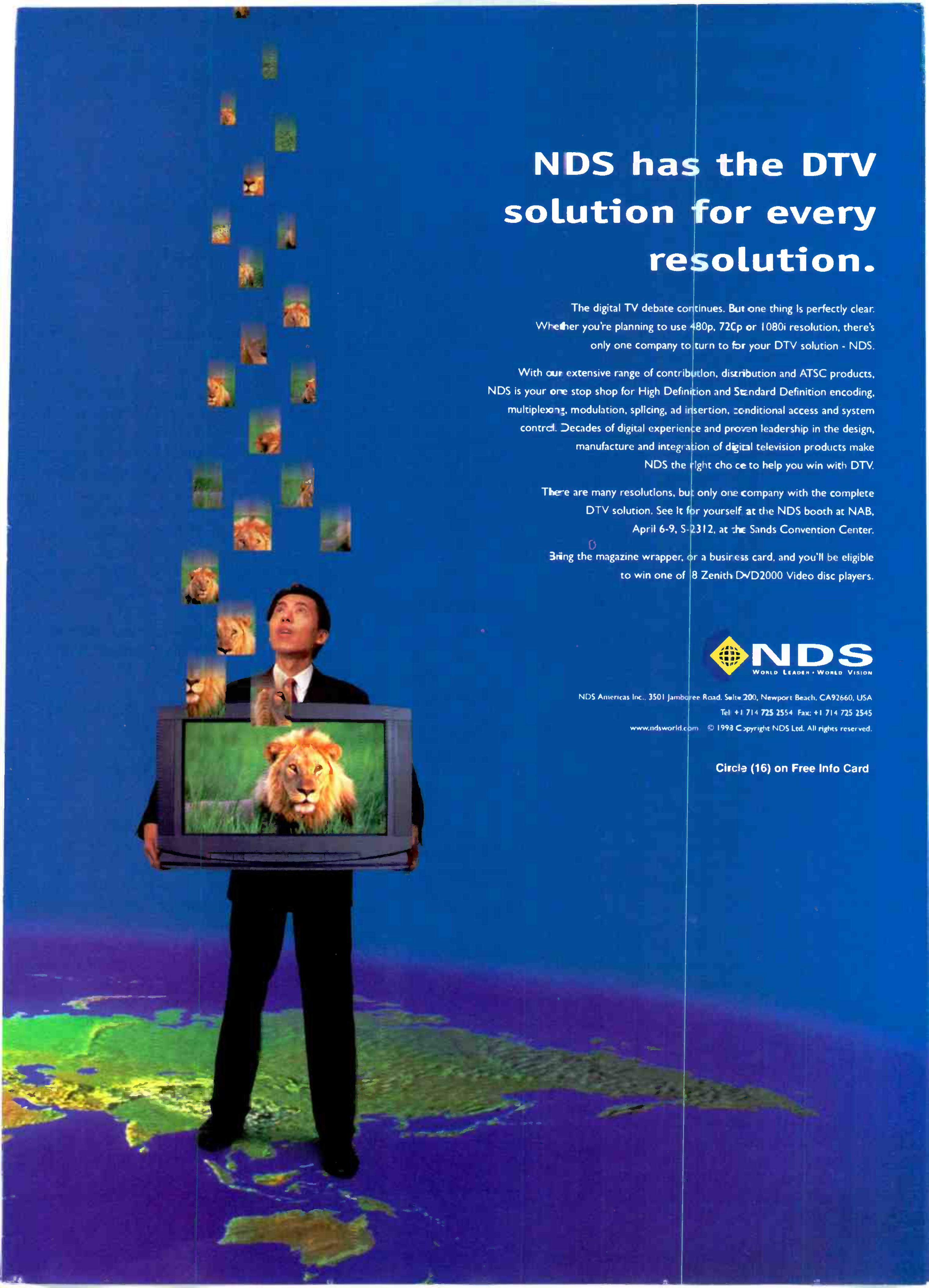

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Circle (16) on Free Info Card

Reader Feedback

re: Networking basics

Hi there.

First off, I have been a subscriber in one form or another since my radio engineering days back in 1963. You have the best magazine in the industry.

In Brad Gilmer's January article starting on p. 52, there is a nice graphic on color coding telephone cable for 10baseT cables. But, there is no mention of straight-through or crossover cables for PC to hub and hub to hub connections. The notation "White/Solid" and "Solid/White" is kinda abstract. It should be "Base (white) and tracer (blue)" for Tip and "Base (blue) and tracer (white)" for the first pair. And on for White/Orange, White/Green through to the last colors in sequence — Purple/Slate, Slate/Purple. (Although you wouldn't go this far for network wiring.)

On p. 54 it says that Thinnet is occasionally called 2BaseT. This is wrong. It should be 10Base2. The "10" refers to the network speed, i.e., 10Mb/s. The 2 refers to the wire size. There is also 10Base5 for RG-8-based cables. "2BaseT" would refer to unshielded twisted pair at 2Mb/s.

Bob Peticolas

Dear Bob,

Thanks for your comments on my column. You are correct that a special cable is required to connect two computers using 10Base-T wiring. See the drawing below:

PIN	SIGNAL		SIGNAL	PIN
1	TD+	<——————>	RD+	3
2	TD-	<——————>	RD-	6
3	RD+	<——————>	TD+	1
6	RD-	<——————>	TD-	2

The notation "2Base-T" was indeed an error — it should have been 10Base-T. The 10 stands for the speed of the network. The "T" stands for twisted pair cable. In the designation 10Base-2, the "2" indicates the approximate maximum cable run in hundreds of meters. See the table below:

DESIGNATION	MAX. SPEED	MAX. CABLE LENGTH	CABLE TYPE	EXTERNAL TERMINATION
10Base-2	10Mb/s	200 meters	coaxial RG-58	50Ω
10Base-5	10Mb/s	500 meters	coaxial Belden 9880	50Ω
10Base-T	10Mb/s	Approx. 100 meters	UTP Cat-3	None req.
100Base-TX	100Mb/s	100 meters	UTP Cat-5	None req.
100Base-FX	100Mb/s	412 meters	2 multimode fibers	None req.

Best regards,
Brad Gilmer

re: Frame Grab and the missing link

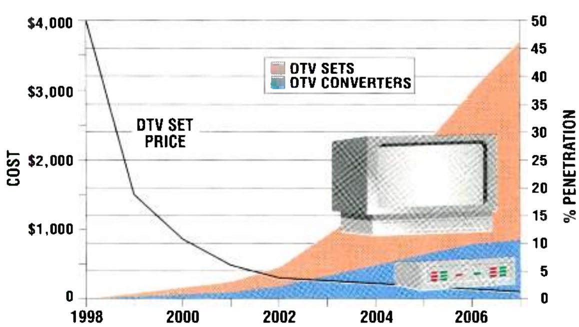
Dear Brad.

The January issue of *Broadcast Engineering* had a confusing graphic on p. 58. The left vertical axis seems to have no bearing. Is there a price curve missing (like with a negative slope?)

Best regards,
Ralph Justus
Director of Engineering
Consumer Electronics
Manufacturers Association

You're right Ralph. See the corrected graphic below.

Editor



Jump start on the future

Brad,

The following got the best of me, therefore, this message to the editor. I am looking at p. 8 of the January issue of *Broadcast Engineering*, the block entitled: ON THE COVER.

I'm wondering how WFBG-TV of Altoona, PA, ever secured a 1965 Chevy van in 1962? Granted, Detroit will give you a three to five month jump on the chronology of the next models, but a three-year advantage? Wow, I knew the Triangle Stations (with Walter Annenberg at the helm) had clout in that decade, but to get such a jump start out of Detroit borders on a modern-day miracle.

Furthermore, referring to p. 16, on the Mt. Sutro Project, I was under the impression that San Francisco is market #4 and Philadelphia is #5. See the last paragraph.

Thanks for your time, Brad, and best regards.

Jesse Maxenchs, CBT
Nee. Orban

Sharp eyes Jesse. The truck that appeared on the cover was a 1965 Chevy van. Although it was high tech at the time, it looks almost prehistoric by today's standards. Readers loved the cover concept — and the engineer's hat! We all had a lot of fun looking back at old issues. For a monthly teaser about broadcasting's history, see the "Freeze Frame" on the second page of each month's Table of Contents.

In checking the "Bowker 1997 Yearbook," San Francisco is still listed as market #5, with Philadelphia market #4. Maybe if you guys had a better football team, you could be #4.

Brad Dick

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Beyond the Headlines

News

Not just another tall Texan

BY LARRY BLOOMFIELD

Most every aspect of the transition to digital delivery of TV signals in accordance with the ATSC standards has its own pitfalls, problems and solutions. The area plagued with the greatest quagmire is the transmission system. It wasn't long ago that none of us knew just what frequency we were going to be operating on until the FCC addressed this issue.

With all of that said and done, we have had to address the issues of transmitter, transmission line and tower with caution and skill, while maintaining current NTSC operation and make this all happen without taking on a debt the size of the federal government.

Much has been said about the availability of qualified tower companies to address these issues in a timely fashion. A sharply tuned crystal ball coming into this would have made our jobs a lot easier. Not every market has a Mt. Wilson or a World Trade Center to put our towers on. At the frequencies we operate, height is a prime consideration over power in getting a respectable coverage pattern of our market.

New tower top cap to be installed. A four-inch steel plate will support a 32,000-pound antenna system. (Photo courtesy of Jay Watkins.)

It is, therefore, not uncommon to find towers scattered around the country that are 2,000 feet or more in height. In the major markets, the decision has been made, but in the smaller markets, there is still time to learn from our big brothers so we don't have to reinvent the wheel.

One such scenario is the RF system at KHOU-TV in Houston. According to David Carr, KHOU-TV's director of engineering, they started planning about eight years ago with a new transmitter building project, which included a new transmitter, tower and building.

Carr knew at that time there were going to be changes in television and possibly a move to digital television. "We planned for it. We built a building that, after it was finished and our (NTSC) transmitter was installed, we still had half of the building empty in preparation for the new transmitter."

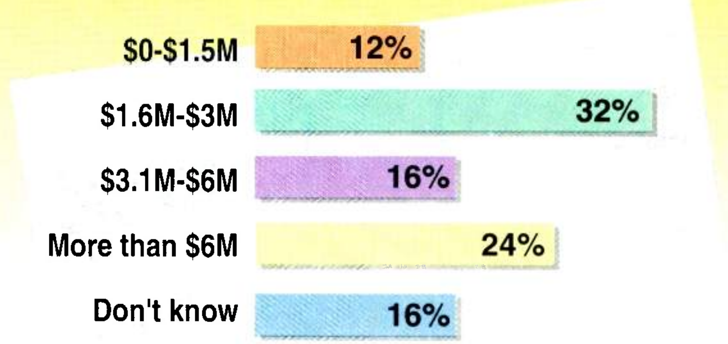
Kline erected KHOU's eight-year-old tower. Most all TV stations in the market are located in one area in a tower farm. According to Carr, the tower farm is located southwest of downtown. "There's no elevation to speak of at the tower farm. The elevation at the transmitter site is 72 feet. KHOU doesn't share its transmitter building site with

FRAME GRAB

A look at the issues driving today's technology.

Station checkbooks are open.

Stations are planning on spending between $3 to $6 million to equip their facilities for digital broadcasting.



KHOU approximate upgrade phase costs:

- Harris transmitter — $800,000;
- Tower modification — $350,000;
- Dielectric antenna — $300,000;
- Transmission line — $360,000;
- Labor to install transmission line and antenna — $300,000

anyone else. Although we are the sole owners of the tower, we do have one tenant — a UHF full-power station."

The height of the antenna is 2,047 ASL and the tower is a guyed, 2,000-foot structure, complete with an elevator that goes to within about 50 feet below the bottom of the lower antenna. The station's NTSC channel is Channel 11 and the DTV channel is 31. Carr wants the DTV antenna to be top-mounted and is currently using a helical Dielectric antenna for NTSC. Because of the additional length of the Channel 31 antenna, the tower will have to be shortened by 55 feet to make room for the DTV antenna. Carr is hoping to get the same footprint with the DTV installation as he is getting with the analog system. They were at maximum clearance from the FAA with the NTSC equipment. The FAA would only grant them up to that height. Carr wanted to maintain the height and also wanted to top-mount the new DTV antenna instead of side-mounting it; so the only choice was to reduce the height of the tower.

David Carr, KHOU-TV director of engineering.

To accomplish all of this, Carr explained his installation in further detail. "What I've got is a tower and at the top of the tower is the NTSC antenna, which is roughly 85 feet long. I'm going to have to remove that antenna, bring it down, shorten the tower, put the new DTV antenna on top of the shortened tower and then put the Channel 11 antenna back on top of the DTV antenna 'stacked.'"

When asked about the coax to the NTSC antenna, Carr said, "The Channel 31 is also a Dielectric and they've taken all that into account. They've figured a way of how to get the feed to the Channel 11 antenna through the Channel 31 antenna." Dielectric constructed the Channel 31 antenna with enough structural integrity to support the Channel 11 antenna."

Carr looks at the channel DTV allocation as a temporary measure. According to Carr, KHOU will remove one of the antennas and increase the tower back to its original height and hopes that when that happens that he may be able to go back to his original channel and it will be on top again, abandoning the Channel 31 antenna.

A tower that high has warning lights and Carr said they use strobe lights. Although they still have to have maintenance done on them, they hardly ever have to be changed.

A Harris-Sigma CD transmitter installed at KHOU. (Photo courtesy of Jay Watkins.)

The antenna work is expected to be finished by the end of July. The transmission line is already on the tower and has been installed and the DTV transmitter is also installed.

Because the balance of the work is being done by outside contractors, Carr's next step is to install the STL, get a hold of an ATSC encoder, master control switcher and put the system together. After the station is ready to go on the air with its digital system, Carr plans to bump NTSC up to the new standards. "CBS is saying they are going to provide me high-definition or 1,080i signals, some during prime time." However, KHOU does not plan to do any multicasting, but doesn't know what CBS' plans are. According to Carr, "At this particular point (our) corporate stand is that we'll do high-definition in 1,080I, one channel, whether it's upconverted or true high-definition originated off film or live."

Does Carr see viewers running out and buying new TV sets once KHOU is on the air with high-definition television? "The viewer demand isn't there because they don't know the difference. High-definition on small screens is a total waste. I would say that a screen, in order for you to appreciate high-definition, has got to be at least 35 inches. RCA had to create the desire for color television in the public by producing *Bonanza* in the early days of color and the industry will probably have to do something similar with DTV and high-definition."

What is the next step in digital in television? "I don't know," Carr responded. "I have in mind several applications that we can put DTV to good use on, aside from delivering a pristine picture with six channels of audio. However, I still keep thinking it's reaching for a killer 'app.' There's got to be a killer application in all of this somewhere."

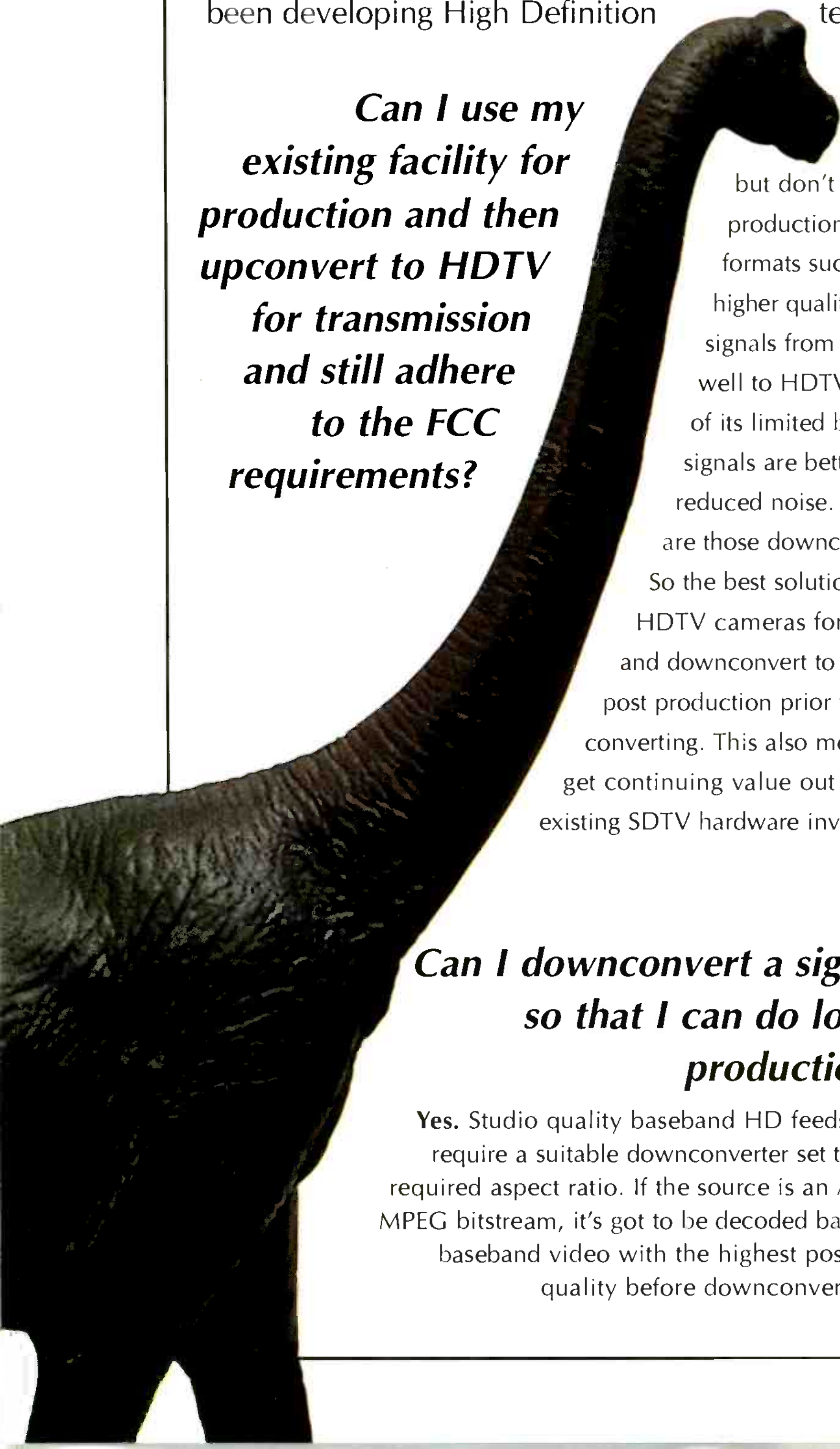
You've got to keep in mind that we are a point-to-multipoint distribution system. So somebody is going to really desire our bits and that we can do a little bit at a time. Some are saying you can change these shots (pictures) you're looking at on a football game or you can do whatever. That's not a killer app. I'm sorry. That's a hobby. I'm talking killer true app. But I don't know what it is. I guarantee it will surface within the next couple of years." ■

SNELL

YOUR SURVIVAL

SDTV? HDTV? Both? – Managing the Evolution

How easily can you adapt to the digital television future? Snell & Wilcox has many of the answers you need. Especially on the question of HDTV. After all, we've been developing High Definition technology for the past ten years.



Can I use my existing facility for production and then upconvert to HDTV for transmission and still adhere to the FCC requirements?

Yes. FCC regulations only require the transmission of a digital signal, but don't specify the digital transmission or production format. Standard Definition (SD) formats such as 480I can be upconverted to higher quality formats, and component digital signals from clean sources upconvert fairly well to HDTV. NTSC is not so good because of its limited bandwidth. D-2 and D-3 digital signals are better than analog because of the reduced noise. The ideal pictures for this purpose are those downconverted from HD. So the best solution of all is to use HDTV cameras for acquisition and downconvert to SDTV for post production prior to up-converting. This also means you get continuing value out of your existing SDTV hardware investment.

Can I downconvert a signal so that I can do local production?

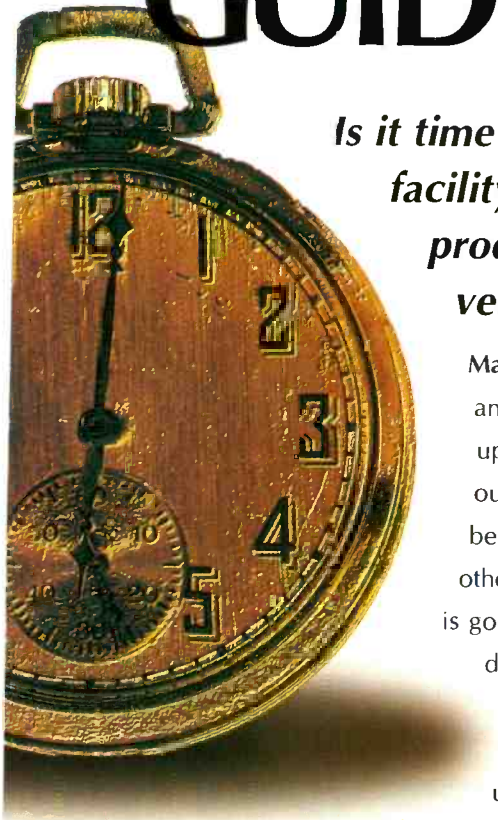
Yes. Studio quality baseband HD feeds just require a suitable downconverter set to the required aspect ratio. If the source is an ATSC MPEG bitstream, it's got to be decoded back to baseband video with the highest possible quality before downconversion.

How do I deal with a

Easy. Compared with clean 601 digital signals, archive material typically suffers from problems such as tape noise, film grain, poor quality transfer, motion weave and sometimes the degradation of old age.

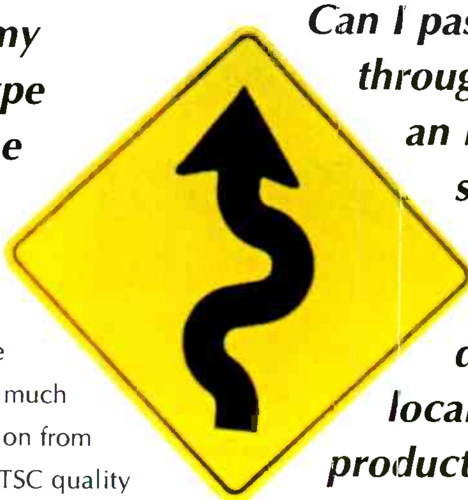
WILCOX

GUIDE TO HDTV



Is it time to transfer my facility to a 601 type production at the very least?

Maybe. 601 isn't HD and will still require upconversion, but the output quality will be much better than upconversion from other sources. If your NTSC quality is good, you could use a high grade decoder and an upconverter to output HDTV in the short term. If it isn't, you should fix it because upconversion reveals poor quality and MPEG encoders don't like noise.



Can I pass through an HDTV signal if I'm not doing any local HD production?

Yes. The HDTV signal you pass through will be MPEG encoded and provided you don't modify it in any way, it's a cinch.

my archive material?

Careful noise reduction and pre-processing of these SD signals prior to upconversion will tackle each of these problems and enable you to maximise the value of your archives.

What kind of quality can I expect when I upconvert my local production for transmission in HD?

Best results are from a 601 digital source. Then analog component is the next best, finally the least good results come from a composite NTSC source. When you have no choice but to use composite, you will need the best decoder. With less than excellent decoding, residual NTSC color subcarrier can remain in the decoded video signal. This is then treated as video by the MPEG encoder, wasting valuable bandwidth.

FCC finalizes DTV channel assignments

News wires were ablaze Feb. 18 and 19 with headlines that read, "Good News — Finally!" "The long-awaited FCC-revised DTV table is out." Officially known as the Memorandum Opinion and Order on Reconsideration of the Sixth Report and Order (FCC 98-24), as adopted Feb. 18, 1998."

The official notification was issued on Feb. 18 by the FCC in which it announced where who was going to do what, putting an end to the long wait for the much-anticipated final DTV allotment table. In the Report ET 98-2OET, broadcasters are told on what channel and with how much power they will be broadcasting their digital TV programming. With this action, the FCC has removed "the biggest fly from the ointment" (see *BE* January 1998 p. 14, "The Scramble for Channels") and broadcasters can begin to get on with the business of procuring and installing those frequency-sensitive components in their DTV chain.

Ed Kennedy, director of operations for KTLA, Los Angeles.

According to the FCC, it has affirmed digital TV (DTV) channel assignments and other technical rules and procedures with minor modifications. In this action, the commission also finalized the core spectrum to be used for DTV, made adjustments to UHF DTV power levels, took steps to avoid adjacent-channel interference and made administrative and technical changes to minimize the impact of DTV implementation on low-power operations.

The action was in response to 231 petitions for reconsideration of the original DTV allotment table that was issued this past fall. In the revised table, the commission made 71 changes. It changed 42 allotments to eliminate specific DTV-to-DTV adjacent-channel situations and 29 allotments addressing specific requests. As part of this action the commission also tightened the technical rules that limit out-of-band emissions from DTV operation and provided flexibility in its administrative processes to encourage adjacent-channel co-locations.

Using software developed by the Community Broadcasters Association, the commission changed 66 allotments in the DTV table to avoid using a channel now used by one or more low-power stations. These changes were made so that the affected full-power broadcasters would have an equivalent situation with their new DTV channel assignment.

In this action, the commission will permit DTV stations to operate with increased power, modify their antenna height, change their transmitter location or take other measures to improve their coverage. Any requested change may not result in more than a 2% increase in interference to nearby populations served by another station. The exception to this is if the affected station already experiences interference to 10% or more of its population, in this case, you won't be permitted to exceed this 10% level.

Approaching maximum power differently, UHF stations will be allowed to increase radiated power up to 200kW within their service area and up to 1,000kW, by using antenna beam-tilting techniques. This is, of course, providing they don't exceed the 2%/10% interference criteria mentioned above.

Under the new directive, TV licensees and permittees will be permitted to negotiate exchanges of DTV allotments on an intracommunity, intramarket or intermarket basis providing these changes don't cause interference to other stations. If there is any additional interference, all affected stations must agree to accept and live with it.

With this ruling the uncertainty about the status of VHF Channels 2 through 6 was dispelled. A core spectrum of Channels 2 through 51 was adopted.

Additional benefits will be derived from this rethinking. The commission believes this should provide more flexibility to address new technical information on DTV adjacent-channel performance while ensuring that there is sufficient spectrum to minimize DTV-to-DTV adjacent-channel interference.

Other benefits derived from this action will be to provide more broadcasters with an in-core DTV channel and eliminate the need for second moves by many stations (Channels 60-69). This should also help reduce the impact of the transition on translators and low-power TV stations, which seemed not to be addressed in the original Report and Order.

Affirming its decision, however, to retain the "secondary status" of low-power TV (LPTV) stations, the commission took additional steps to assist low-power stations that may be displaced or otherwise impacted by DTV operations. The commission said, "LPTV or TV translator stations eligible to seek a new channel will not be subject to competing applications if they face predicted interference either to or from any allotted full-service DTV facility, and that such requests will be given priority over other low-power applications." In addition, the commission modified its technical rules to improve sharing between low-power and full-power stations.

When asked about non-commercial stations, a commission spokesperson said, "At the end of the DTV transition period, the commission would consider establishing additional DTV non-commercial reserved allotments for existing non-commercial reserved NTSC allotments that cannot be replaced at this time."

The decision has had its impact on everyone. KTLA's (Los Angeles) director of operations and engineering, Ed Kennedy, shortly after the table had been released said, "Tribune is committed to having KTLA on the air, following the FCC mandate. Our current planning and project implementation is designed to meet that schedule. Obviously, now that we have a channel assignment, we can commit our vendors to supply us with the equipment we need." Kennedy said there were changes, "We were originally assigned Channel 68 and now we're on 31. We know what our power will be and we can go forward."

On the other side of the country, Evan Watson, WETA-TV's (Washington, DC) project manager for HDTV said, "We were assigned to Channel 34, but the new assignment give us Channel 27. We operate on 26 for NTSC and that creates an issue for potential interference due to the adjacent-channel status. At least we can now move along. We will now have to order a new antenna as the Channel 34 one we have is too far away from 27 to be of any use to us." Watson said, "This is a giant pain, but someone will need a Channel 34 antenna and we'll work a deal."

According to the commission, the whole purpose of these changes is to facilitate the conversion of over-the-air TV broadcasting from analog to digital broadcasting. The commission will issue a public notice on its processing procedures for construction and modification applications.

A copy of the revised DTV table of allotments is available via the Internet at www.fcc.gov/oet/dtv/. ■

ATSC restates HDTV and SDTV transmission standards

The Advanced Television Systems Committee (ATSC) has restated the HDTV and SDTV transmission formats within the ATSC digital TV standard.

According to the ATSC, six video formats in the ATSC DTV standard are high-definition television and include the 1,080 line by 1,920 pixel formats at all picture rates (24, 30 and 60 pictures per second), and the 720-line by 1,280-pixel formats at these same picture rates. All of these formats have a 16:9 aspect ratio.

The other 12 video formats, although they represent some significant improvements over analog NTSC, are not high-definition television; they are referred to as standard-definition television and include the 480-line by 704-pixel formats in 16:9 widescreen and 4:3 aspect ratio, at the picture rates listed above, and the 480-line by 640-pixel format at a 4:3 aspect ratio at the same picture rates.

These definitions are restatements of terms established and supported by the written record of the 10-year process of the FCC, the FCC Advisory Committee on Advanced Television Service and the ATSC. They also support the industry definitions for digital TV receivers established in January by the Consumer Electronics Manufacturers Association (CEMA).

These definitions are also fully supported by the technical specifications for the various formats as measured against the internationally accepted definition of HDTV established in 1989 by the International Telecommunications Union (ITU). ■

Expanding their horizons terrestrially

Since our story last month about DirecTV, additional information has come to light. It appears there are 33 markets in 16 states where, if you are an American Telecasting, Inc. (ATI) customer living in a multiple-family dwelling unit (MDU), you won't need an 18-inch dish to get DirecTV. In an agreement between the two companies, ATI intends to expand its programming service in the MDU market.

This is a continuing effort on DirecTV's part to provide service with the top private cable and wireless operators, in addition to its more than three million customers who own a DSS dish. The combined DirecTV service available through ATI will be available in the Rocky Mountain and Midwest regions early this year.

The pact will provide ATI's MDU customers with the opportunity to receive access to the 175-channel DirecTV programming service. Under the agreement, ATI also will provide its customers with access to the U.S. Satellite Broadcastings' premium movie service that uses some of the transponders on DirecTV's DBS-1 satellite.

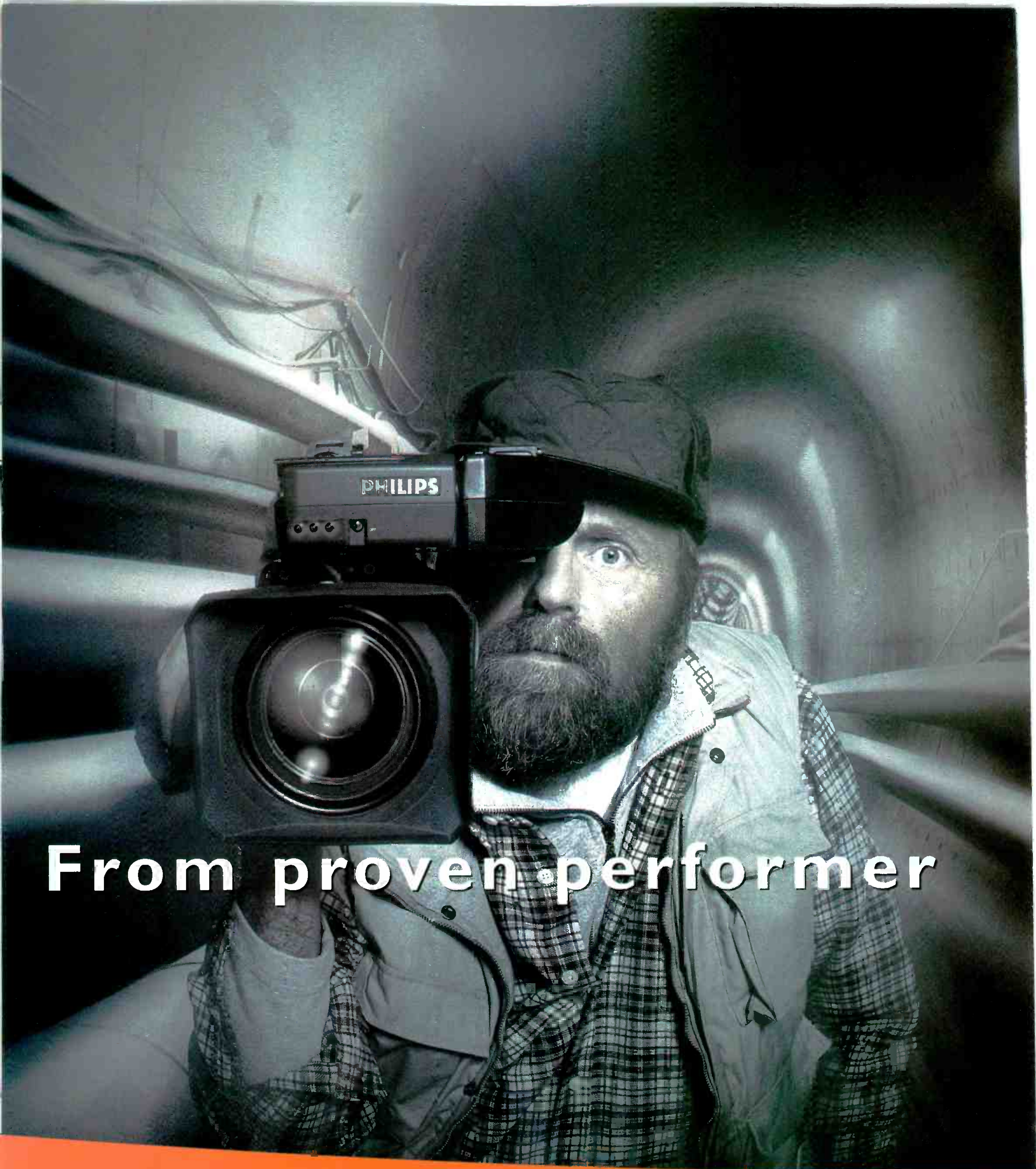
John McKee, vice president of special markets and distribution for DirecTV.

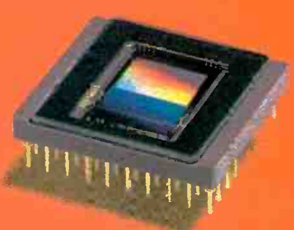
Both companies are jubilant over the arrangement. "Our agreement with ATI is an excellent match for both parties," said John McKee, vice president of special markets and distribution for DirecTV. MDU residents will have available, for a monthly fee, as yet not disclosed, a digitally delivered service with a broad selection of sports and movies. It only makes sense that this will also make the new digital HDTV services DirecTV has announced available to these ATI subscribers, as well.

John Suranyi, senior vice president for ATI said, "DirecTV programming is a great complement to our 20- to 30-channel line-up and further enhances our long-term prospects in this market." There may be some duplication in programming if all the DirecTV regular programming is offered. It will, however, provide subscribers with the local-market TV stations, which DirecTV does not provide.

John Suranyi, senior vice president for ATI.

This agreement between ATI and DirecTV becomes part of a nationwide network of more than 200 DirecTV system operators that sell, install and maintain Direct Satellite Service systems in MDU buildings. Some of the other wireless cable operators climbing on board the DirecTV bandwagon in the past few months are CS Wireless, Plano, TX; Wireless One, Jackson, MS; and Heartland Wireless Communications, Inc., Dallas, which is the nation's largest wireless cable TV company. ■





Progressive Scan

Choosing the right camera system is critical to success in migrating to DTV. That's why Philips Digital Video Systems is ready now with DTVCAM, the most cost-effective studio/field DTV solution available. Based on the high performance LDK 20/20P system, DTVCAM features unique Philips True Frame Progressive™ CCD chip technology. Only Philips TFP™ scanning provides full image sampling, for film-like pictures that take imaging to the next level. DTVCAM is compatible with current broadcast equipment,

Getting it up on the screen — bright and clear

The only way to appreciate the qualities of a true, high-definition TV picture, irrespective of its aspect ratio, is to view it on a display device larger than 36 inches. If this is true, then proponents of HDTV should be looking into the different types of "larger than 36-inch" displays that are available. Because direct-view color picture tubes of that size are not practical, that type of display won't be considered here. CRTs are used in several types of projection TV systems. We will address the techniques used by Hughes-JVC and the technology invented by Dr. William P. Bleha and other scientists at the Hughes Research Laboratories.

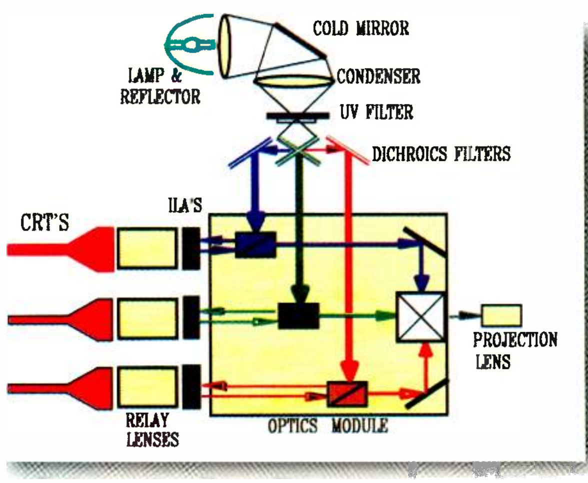
It is necessary to be familiar with some of the terminology used in the TV projection business. Do you know what an image light amplifier (ILA) is? Tom Brown, director of sales applications for Hughes-JVC said, "The ILA was formerly known as a liquid crystal light valve (LCLV). The new name was chosen to emphasize its function rather than a technical description of the device. The device acts as an electronic "film" to modulate illumination from an Xenon arc lamp in exact response to a low-level input image from, in this application, the CRTs." The ILA acts just like the grid in a triode. The Xenon arc lamp is the cathode and the light it emits is like the electron flow through the triode with the screen being the plate or anode (with no B+).

The CRTs that are the drive to the ILA are flat-faced infrared-emitting devices. The infrared images from the three CRTs are focused onto the backs of the three ILAs. The ILAs permit the infrared light to change its reflecting properties, modulating the light source from the Xenon arc lamp, as it is reflected, at a video rate. The changes in the infrared determine how much light the mirrors (ILAs) will reflect light; the more the infrared, the more light is reflected.

The three ILAs are illuminated with red, green and blue light from a common Xenon arc lamp, which has gone through a diachronic beam splitter. Because the Xenon lamp runs hot, the light from the Xenon lamp shines into a heat trap so that only cool light proceeds through the diachronic beam splitters and on to the ILAs. The beam splitters are only 50% efficient due to polarization.

The DLA-G10 projector from JVC.

The spot diameter of the electron beam on the infrared CRTs, which determines its resolution, will only provide about 1,200 TV lines per picture height. That works out to 1,600x1,200. Because the ILA and the CRT produce analog images, there is no hard limit, however, limiting the horizontal direction to 1,600 pixels, as would be the case with a matrix device. There is non-aliased response out to beyond 2,000 lines so that it can produce excellent HD pictures.



The light path in a single-lens ILA system.

The Hughes-JVC projector is manufactured to accommodate just about any kind of video: PAL, SECAM, NTSC, S-Video, CVID, SVID, VGA, SVGA, RGB with sync on green, RGB with H&V or composite sync. The flexibility of the device to accommodate all these different formats also tends to limit it.

Due to the multiformat capabilities of this projector, it has an on-board sync generator and a decoder. The unit phase locks to the sync of the incoming signal and the digital raster timing generator (RTG) generates a raster signal for the deflection system that replicates the incoming signal as analyzed by the system control computer. It is capable of reproducing either interlace or non-interlaced signals as directed by the signal analyzer.

Environmental issues also need to be addressed when servicing these projectors. There is fluid in the prisms that is harmful to the eyes, respiratory system and skin. Cooling oil is used in the CRTs. Both products require special handling and must be disposed of properly.

The Hughes-JVC projector delivers what appears to be the brightest and best resolution picture onto a big screen. Just think what it can do in a conference room or on a living room's home theater system.

Dr. Bleha's papers have appeared in the SMPTE Journal. You can access additional information from the Hughes-JVC web site at www.hjt.com. ■

Editor's note: JVC has recently launched the first D-ILA projector. The DLA-G10 is a lightweight, 1,000 lumen, 28-pound projector. It delivers super brightness and high resolution found in larger models of ILA-based light valve projectors, but with a significant difference. The performance comes in a portable, plug-and-play package. The Direct-Drive Image Light Amplifier (D-ILA) device is an original development by JVC and an extension of the ILA that was developed by Hughes-JVC for large-screen theatrical projectors.

Larry Bloomfield is a former chief engineer, industry consultant and author, located in Bend, OR.

FCC Update

DTV application filing procedure update

BY HARRY C. MARTIN

The following is a summary of the procedures the FCC has established for the transition to DTV:

• *DTV applications.* A construction permit (CP) application must be filed on or before the midpoint of a station's DTV construction period, as previously established by the commission. The application deadlines are as follows: 1) May 1, 1998, for network-affiliated stations in the top 10 markets; 2) Aug. 3, 1998, for network-affiliated stations in the remaining top 30 markets; 3) Nov. 1, 1999, for all remaining commercial stations; and 4) May 1, 2000, for all non-commercial stations.

Affiliates of ABC, CBS, NBC and FOX are included as network affiliates, while affiliates of The WB and UPN are not. The applications are treated in the same manner as applications for minor changes in TV broadcast facilities. Most of the rules, policies and procedures that apply to processing minor change applications will apply to processing DTV applications.

Applicants are required to complete sections I and VII (fee information and certifications) of FCC Form 301 and the new section V-D-DTV Broadcast Engineering Data.

• *DTV engineering.* The new engineering section is tailored for DTV. Applicants should submit all data and exhibits called for in Section V-D for the proposed facility. Some information may be incorporated by reference, so long as that information is current and the applicant provides the call sign and file number from which the information can be retrieved; doing so will slow the application processing time.

The commission is discouraging applicants from incorporating any information by reference. Section V-D begins with a certification check list, a series of questions where applicants may certify compliance with key processing requirements. These requirements include conformance with the DTV table of allotments, safety of air navigation, environmental protection, signal coverage over the community of license, and protection to radio astronomy, radio receiving or FCC monitoring installations. Applicants who can answer "yes" to all questions may expect quicker processing. Some applications, such as those in border areas, may be delayed due to coordination requirements.

No technical showing will be required of applicants who can certify that the proposed facility conforms to the DTV table of allotments and specifies operation at an antenna site within 5km of the reference allotment site, with an antenna height above average terrain (HAAT) that does not exceed the allotment reference HAAT, and with an effective radiated power (ERP) in each azimuthal direction that does not exceed the allotment reference ERP in that direction. Applicants who cannot make such a certification will be required to submit a technical showing that the proposed facilities will not result in additional interference to analog TV broadcast and DTV service or to DTV allotments.

• *Interference consideration.* The commission has provided flexibility for proposals that could be affected by potential new interference. The FCC will consider granting such applications on the basis of interference agreements if it finds that such grants will serve the public interest. Any party submitting such a proposal must file the interference agreements, signed by all pertinent parties. The applicant must also supply a list of parties predicted to receive additional interference from the proposed facility, a showing as to why a grant would serve the public interest, and a technical study showing the additional interference that would result from operation of the proposed facility. Applicants who use a voluntary coordination process should provide the name, address and phone number of the person who performed the coordination studies, together with a description of how the coordination process was open to all interested parties, including LPTV and TV translator operators.

• *Expiration of CPs.* DTV CPs will expire on the station's scheduled construction deadline previously established. When a station is ready for operation, a permittee may begin operation with program tests, so long as any condition on the DTV CP has been met, the FCC is notified , and an application for license is filed within 10 days. ■

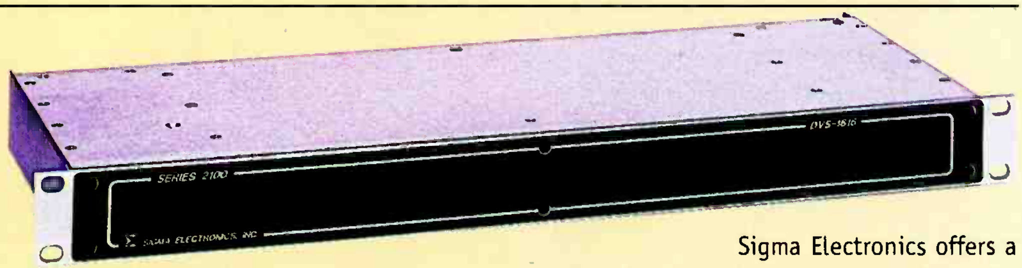
Harry Martin is an attorney with Fletcher, Heald & Hildreth, PLC., Rosslyn, VA. He can be reached at martin@fhh-telcomlaw.com.

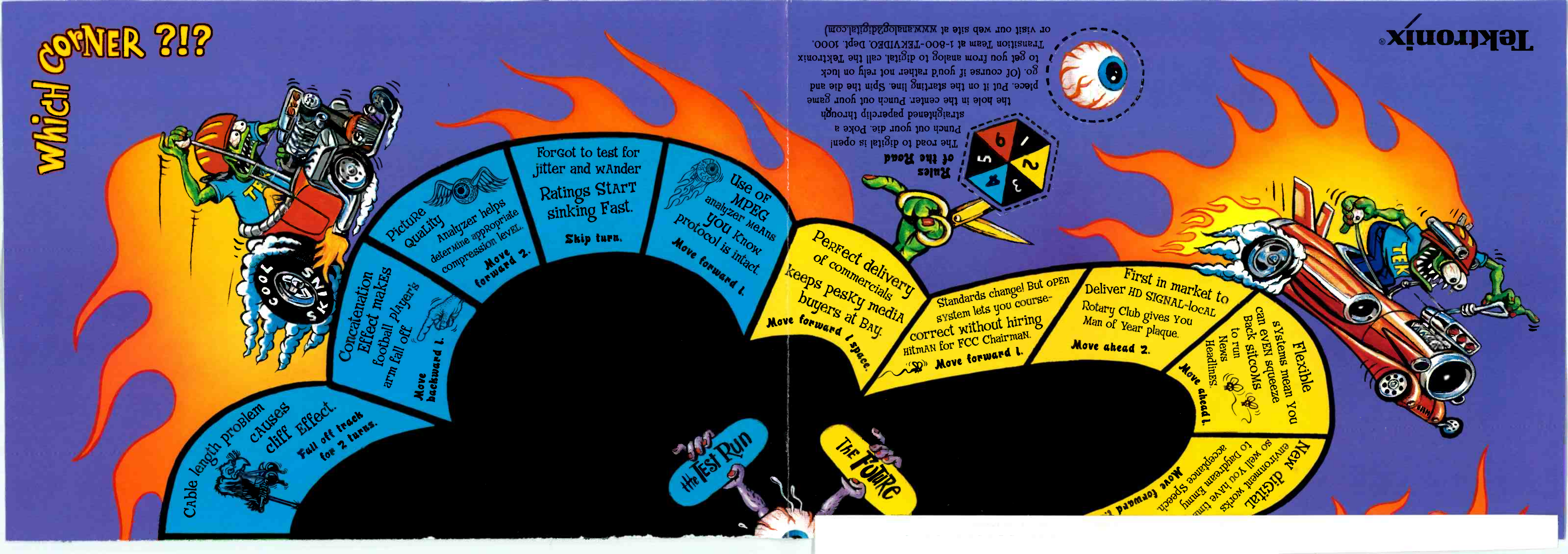
Dateline

Television, TV translator and LPTV stations in Arizona, Idaho, Nevada, New Mexico, Nevada and Utah must file their renewal applications on or before June 1, 1998. Wyoming TV stations also must file their renewals by June 1, which is the optional early date for Wyoming TV translator and LPTV renewal applications.

Commercial TV stations in the following states must file their annual ownership reports by April 1: Alaska, Georgia, Massachusetts, Rhode Island, Colorado, Minnesota, Connecticut, Maine, New Hampshire, Vermont, Montana, North Dakota and South Dakota.

Tower owners in Connecticut, New Jersey and South Carolina must register with the FCC between April 1-30, 1998.




Which Corner ?!?
Cable length problem causes cliff Effect.
Fall off track for 2 turns.
Concatenation Effect makes football player's arm fall off.
Move backward 1.
Picture Quality Analyzer helps determine appropriate compression level.
Move forward 2.
Forgot to test for jitter and wander Ratings Start sinking Fast.
Skip turn.
Use of MPEG analyzer means you know protocol is intact.
Move forward 1.
Perfect delivery of commercials keeps pesky media buyers at Bay.
Move forward 1 space.
Standards change! But open system lets you course-correct without hiring Hitman for FCC Chairman.
Move forward 1.
First in market to Deliver HD SIGNAL-local Rotary Club gives You Man of Year plaque.
Move ahead 2.
Flexible systems mean You can even squeeze Back sitcoms to run News Headlines.
Move ahead 1.
New digital environment works so well You have tim
to Daydream Emmy acceptance Speech.
Move forward
The Test Run
The Future
COOL SKINS
TEK
Rules of the Road
The road to digital is open! Punch out your die. Poke a straightened paperclip through the hole in the center. Punch out your game piece. Put it on the starting line. Spin the die and go. (Of course if you'd rather not rely on luck to get you from analog to digital, call the Tektronix Transition Team at 1-800-TEKVIDEO, Dept. 1000, or visit our web site at www.analog2digital.com)
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the ASSEMBLY

Don't Let Hardware Decisions Drive You Around The Bend.

Any way you look at the road ahead, you're going to hit three big hardware crossroads: master control, servers, and routers. (Stay tuned for testing.) Let's start with the master control. The question isn't if you'll replace yours. It's when. Not so fast, you say. I'll just do the bitstream splicing thing and avoid shelling out for a new master control altogether. Well, this is one of those cart before the horse situations. Right now, splice points are far from being standardized. The network feed and your regional feed don't have matching splice points. Which means they may be totally different, which means you could end up paying for a capability you can't even use. Besides, you don't want to give up voice-overs and bugs as you move to DTV. Our advice: build your new system step-by-step, using digital building blocks. This way you'll extend the life of your hardware beyond standard definition while you're building the foundation for HDTV.

Will You Live If Your Server Crashes?

Central servers were a nice idea. Of course, the same could be said for bell-bottoms, disco, and powdered orange juice. While fashions have a way of coming back in, central servers seem to be on their way out. Distributed servers, like the Tektronix Profile® video servers, on the other hand, are definitely the "in thing." They scale up better, they're flexible, and they're a heck of a lot more reliable. If your central server goes down, everything goes down. If one of your distributed servers goes down, the rest of your servers will still be up and running. The other big issue with central servers is they force you to pay up-front for capability you may never use. Distributed servers, on the other hand, let you add anything from edit suites to extra channels as you go.

The Easiest Route To Routers.

We'll cut right to the chase: get those digital routers now. And you don't have to buy a bunch of pricey ones that only support HD. A mix of routers that support compressed and uncompressed signals will probably work fine. The key to router happiness is finding balance, Grasshopper. In fact, 270 or 360 Mbits/s digital routers can already handle compressed HDTV. Just be sure to partner with a vendor knowledgeable enough to help you reach enlightenment.

What Does That Flashing Idiot Light Mean?

Now you're really moving! So what's the problem? In this new digital world signals are supposed to be perfect and you don't have to give a second thought to testing, right? Wrong. The fact is, digital has its own unique testing challenges. So plan on spending as much to monitor digital picture quality as you do monitoring analog. In digital, the need for measurement doesn't change. The measurements do.

N THE Road to DiGiTAL!

THE FUTURE

The Road To The Future Is Open.

Your station could lose some of the flexibility you've grown accustomed to when it passes digital programming through. For example, imagine being powerless to squeeze back the credits on Roseane to make room for your own news promos. The key is investing in equipment that lets you maintain control of your facility and frees you from being completely dependent on the network feed. The bigger issue is that by building an open environment you'll be able to handle stuff the networks send your way while the dominant standards emerge.

Do The People Making The Maps Know Where They're Going?

Not coincidentally, it's often the case that the standard a company touts happens to be the standard their products support. The important thing is to find out if the vendor you're going to work with actually participates on the committees that create the standards the industry will follow. That way you can be sure that the products you buy support a long-term solution, and not somebody else's quarterly profits.

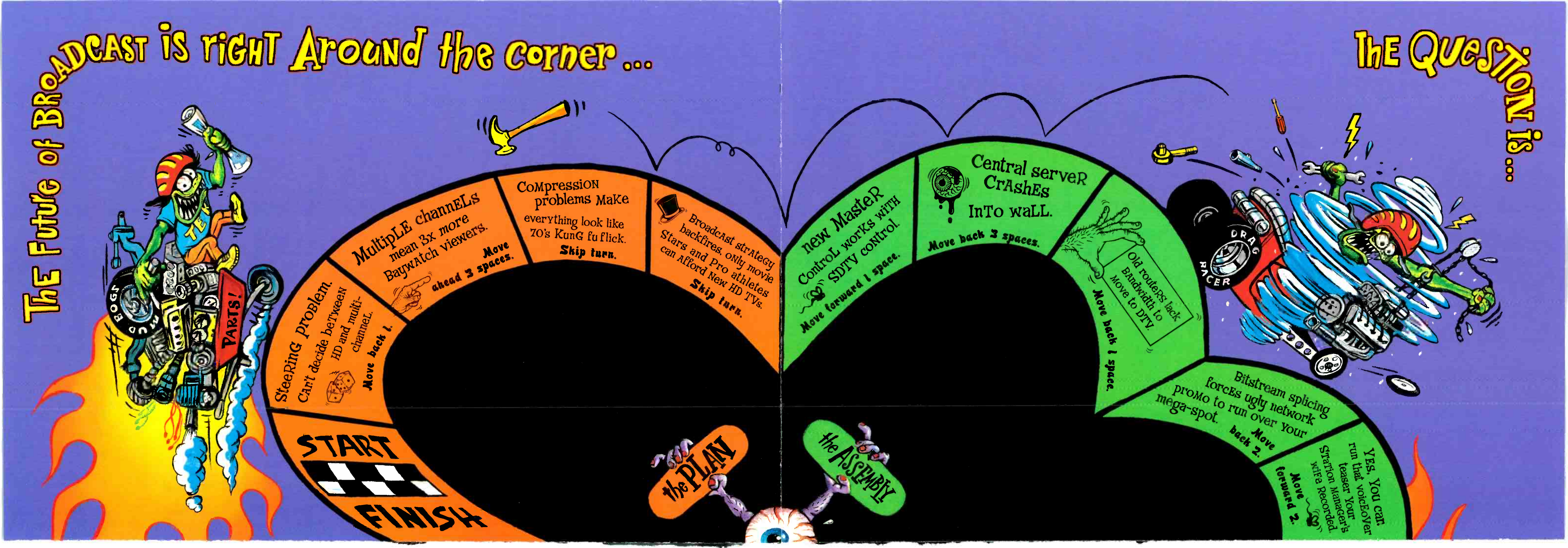
Where's The Finish Line?

Fast-forward a few years. It's three o'clock on a fast-paced news day. Your news team is covering a breaking story live from the scene. They access the studio archives electronically, over the network, pulling together material from previous stories. In the news van, an editor weaves the live feed and the archival information together, running everything through the graphical template that gives your newscasts its unique look. At the same time a reporter crafts a rough draft of the story, tying the visual elements together. The completed story is wired back to the studio where a producer pulls the story up and goes to work polishing it.

At 4:15 the controller runs the breaking story's headline along the bottom of a network-supplied sitcom. At 4:45 he includes 15 seconds of teaser footage. Three minutes into the 5 o'clock news the team on the scene feeds dramatic live action directly to the station's Profile servers. The controller routes the raw images to the anchor, who seamlessly edits them into her newscast while it's in progress.

Viewers flood your web site for more information on the story. They can access previous stories on the same topic from your news database, see footage that got edited out of the newscast, and look over the reporters' field notes. The news team's email box begins to fill. During a break in the action they fire off responses. Meanwhile, after tallying viewer votes, you broadcast the evening's winning film at full resolution and with 6-channel surround sound. Then you sit back, relax, and oh yeah, pull up that Emmy acceptance speech you've been trying to finish.

Tektronix®


The Future of Broadcast is right Around the corner ...
The Question is ...
PARTS!
MUD BOGS
DRAG RACER
START
FINISH
Steering problem. Can't decide between HD and multi-channel. Move back 1.
Multiple channels mean 3x more Baywatch viewers. Move ahead 3 spaces.
Compression problems make everything look like 70's Kung fu flick. Skip turn.
Broadcast strategy backfires. Only movie stars and pro athletes can afford new HD TVs. Skip turn.
new Master Control works with SDTV control. Move forward 1 space.
Central server crashes into wall. Move back 3 spaces.
Old routers lack bandwidth to move to DTV. Move back 1 space.
Bitstream splicing forces ugly network promo to run over your mega-spot. Move back 2.
Yes, you can run that voiceover teaser your Station Manager's wife recorded. Move forward 2.
the PLAN
the ASSEMBLY

the PLAN

Ladies And Gentlemen, Start Your Engines.

You already know where you want to go. The question is, how will you get there—preferably with your studio and sanity intact. As you come blasting off the starting line the first thing you're going to hit is a fork in the road: Open-System or Closed-System. Go Open-System and you get flexibility. The flexibility to assemble your facility piece by piece, and choose the application software you want as your budget and needs evolve. If, say, HDTV gets hot, you can turn on a dime and adjust. So the question isn't can you afford to start making the transition now; it's can you afford not to.

Another way to get where you want to go is simply to buy everything at once. This is the Closed-System approach and it'll cost something like the gross national product of a developing country. Up front. And just because everything is supposed to work together doesn't mean it always will. (Consider some of the people you work with.) It also assumes standards won't change. Again.

Digital Or Bust.

Okay, so you don't have a sum equivalent to the national debt to spend on new hardware tomorrow. With an open-systems approach you can stick closer to your present spending levels and still build a digital facility long before you hit retirement age.

Just remember that prior to deciding what kind of hardware to buy, you need to ask yourself what that hardware is going to buy you. Because you're not just creating an open-system, or a digital facility. You're also creating an on-air presence. A look. An identity to compliment your broadcast strategy.

Getting Out Of Neutral.

Is your strategy to wait and see how this HD vs. multi-channel thing is going to shake out before you hit the gas? Bet the farm on HD and if the price of new TVs doesn't drop in a hurry, it's back to the pits. Bet the farm on a multi-channel format to attract viewers and you won't be prepared for HD. And hey, what about compression? Which type? Which standard? Will it even work at all? Aaargh! Hit the brakes, we're going to crash!

No need to panic. You can get in gear simply by following that open road. By keeping yourself and your system open and flexible, you can accommodate multiple channels, SD, or HD without your competition passing you by. And you can deal with stuff that pops up down the road.

Avoiding the potholes o

the TestRun

This Is Only A Test.

It's important to get ready for your testing demands the same way you build an open broadcast facility. That means buying open platforms so you don't have to throw out test instruments every time formats change. For example, with a VM700T Automated Video Test Set, you can change functionality just by adding firmware cards. How long will you have to worry about testing? A pretty good rule of thumb is, you only have to test as long as you have viewers.

How To Pass With Flying Colors.

Follow these six steps and you'll blow by every test that comes your way.

1. Figure out how much testing is enough. If you're relying on your old measurement techniques and equipment to test digital, your signal won't just get worse. It could completely conk out.

2. Is your signal path longer than the Baja 5000? And just as tortuous? Remember, the longer it is, the worse it is. A WFM601 Waveform Monitor can measure cliff effect, the point at which signals fall apart and your viewers are forced to watch their screen go black instead of their regularly scheduled programs.

3. Squeeze in compression testing. Obviously sporting events require more bandwidth than daytime soaps. With a Picture Quality Analyzer you can get the measurements that allow you to set the right compression levels for any kind of programming you're putting out.

4. Jitter and Wander: This is not something that happens if you've had too much coffee. It's what can happen to the digital content you'll be getting from the outside—and trust us, at first you'll be getting most of your content from the big guys. So use a Video Test Set to keep your viewers from wandering.

5. Protocol Monitoring: This is not a better way to conduct your meetings. It's what you need to make sure that your signals have been properly compressed. If a signal isn't compressed right, it's like trying to read *Wired* with a nasty hangover. Fortunately, an MTS 200 MPEG analyzer can help you clean things up.

6. Look your best. Measuring picture quality in the digital world comes down to comparing the input picture to the output picture, and thus avoiding the dreaded concatenation affect: people's arms and legs falling off, distortion, edge noise, etc. To make sure your signal meets picture quality standards your stations and your viewers' demand, you'll probably want that next generation testing tool, the Picture Quality Analyzer, to help you take the guesswork out of what you're broadcasting. Okay, so you still have to test no matter what. But now you've got a cheat sheet.

Progressive or interlace: What will you do?

BY LOUIS LIBIN

The new DTV system in the United States is a significant advance over our current NTSC TV standard. The new DTV standard uses digital compression, packetization and 8VSB modulation, providing high-quality images, CD-quality audio and the provision for data transmissions. The new standard relies on multiple video formats, providing great flexibility for broadcasters. Most stations will choose 1,080 interlace or 720 progressive as their main production format. The stakes are quite high; stations have a great opportunity to replace all of their existing analog broadcast system with a new digital system.

What to choose?

By numbers alone, it sounds as though the 1,080 interlaced format will provide the best resolution. However, in reality, the 720p is comparable in the vertical resolution to 1,080i. The 1,080i x1,920 format will offer greater horizontal resolution. The 1,080x1,920 progressive formats provide the highest spatial resolution, but with lower temporal resolution. Different formats will be chosen for different types of programming.

Multiple formats

There are multiple formats because TV applications have different performance requirements. These formats allow trade-offs specific to each type of program material. Five of the six ATSC HDTV formats are progressive. One of the most exciting things about the standard is that film-based material, including all movies and 70% to 80% of prime-time programming, can be shown in 1,080x1,920 progressive scan at 24 frames per second. Film material may be automatically transmitted using progressive scan formats. It would be less efficient and more difficult to use interlace for film-based material. Therefore, from the initial transmission, most digital TV programming will be in progressive scan.

Some say that "high-definition" applies only to 1,080 lines of progressive scan. Although the technology does not yet exist to allow broadcasters to transmit 1,080 lines of progressive scan in the digital channel, such technology should be available soon. Keep an eye out at the NAB convention. The "best" HD is 1,080x1,920 progressive at 60Hz into a 6MHz channel, but there are various approaches being attempted to mimic this high-definition format. A true 1,080x1,920 progressive scanning format is not on the horizon yet.

The great debate

Although progressive and interlace scanning have their proponents, few broadcasters are on the fence. Because of statements made by the computer industry, some broadcasters believed that the ATSC standard was fundamentally flawed. This could have caused consumers to not support DTV. An agreement between the computer and TV industries expressed the importance of extensibility and noted the standard's ability to carry new elementary bitstreams in a backward-compatible way. The major component of the compromise removed constraints that the ATSC specification had placed on the MPEG-2 video standards for Main Profile@Main and High Levels. The result was a better fit of frame rates and pixel arrays for the various formats. Now, we have the potential, using the FCC standard to have interlaced and progressively scanned pictures with resolutions up to 1,152 by 1,920 pixels and frame rates up to 60Hz.

Format showdown at NAB

The U.S. government, through the FCC, has ensured that within the next few years, each of the 1,600 existing broadcasters will spend hundreds of millions of dollars collectively on new equipment so that they can broadcast some form of digital television. The penalty for non-compliance will be loss of license, which is pretty severe by any standard. Expect the NAB convention to be an historic event in the format war, and look closely at the equipment and the direction the manufacturers are headed. There may be a major showdown of sorts between 720 line progressive and 1,080 line interlace. ■

Louis Libin is a broadcast/FCC consultant in New York and Washington.

TV manufacturers to showcase HDTVs at NAB

Attendees at this year's NAB can get a glimpse of what TV manufacturers will be selling, at retail, later this year by visiting the TV Broadcast Sales Exhibit Hall in the Las Vegas Hilton Pavilion. Sponsored by CEMA, HDTVs by Panasonic, Sharp and Zenith will be on display and in family room environments similar to those consumers will enjoy. And, don't miss other manufacturers' displays of HDTV like Sony, Philips and Matsushita in the Las Vegas Convention Center.

Where are they going?

CBS	1,080 line interlace for video, progressive for film
NBC	Under development
PBS	Stay tuned
ABC	720 line progressive
FOX	720 Line progressive
Sony	1,080 line interlace
Warner Brothers	1,080 line interlace

Expert's Corner/Vendor Views

Defining HDTV

Initially, HDTV was assumed to mean a 1,080-line, interlaced signal. Today, other (and much less-expensive) display formats are being discussed and proposed. Can a facility simply adopt one of these lower-quality image formats and get away with calling it "HDTV" without penalizing themselves in terms of their marketplace perception? After all, will the viewers even know?

(Next month, a look at the vendor views on this topic.)

EXPERT

I think that what is needed is an industry-wide scheme, similar to that used by the CD industry. I propose the following:

Roy Trumbull, assistant chief engineer, KRON-TV, San Francisco.

Source material:
D = digital
S = standard-definition (480 lines)
M = medium-definition (>680 lines, <900 lines)
H = high-definition (> 900 lines)
A = analog
F = film
S, M, H

Scan:
C = upconverted from a standard-definition format
L = letter-boxed
P = progressive scan
No notation used for interlaced scan

Audio:
2 = true stereo including dialog
2M = only music and sound effects in stereo
5.1 = program produced in full AC-3 format
No notation used for mono or synthesized stereo

While an industry committee could probably expand this to 16 pages of codes, at the expense of 50 gallons of coffee and some stale scones, it must be kept simple to make it work at all. The goal is to give true HDTV programs a cache that will easily fit into the TV listings.

Although we are concerned about the broadcasting side, we must be equally concerned with the DTV set manufacturers. I approve of the idea of certifying that receivers meet minimum standards.

The first time I visited a TV station in the early 1950s, I heard the director say, "Go to black." The monitor screen went to black. That was the first time I'd seen that happen. The set manufacturers had saved 50 cents by leaving out the DC restorer circuit in many of the black-and-white televisions. They went to a light gray when the picture "went to black."

I tell my friends to turn off the color when they shop for a TV and look at the gray scale. On many color televisions it's awful. *Consumer Reports* recently noted that the tuners in many 20-inch sets were of inferior quality. I find that the tuner in a VCR often has better shielding and freedom from interference than the tuner in the TV set it's being used with. ■

EXPERT

I once was acquainted with someone whose definition of compromise was "putting up with what you don't like until you can change it." Not exactly a classic or Webster's definition, and usually not in the best spirit of any negotiation. However, in the context of HDTV, it may be the best expression we have for what we need to do.

The compromise, in this case, must be in the arena of TV sets, set-top converters, cable plants, satellite plants and terrestrial over-the-air systems. As a major origination, production and post-production provider we cannot in good conscience do anything but 1,080 if we advertise ourselves as HDTV. As currently defined, this is the standard to which we should aspire for true HDTV acquisition. 1,080i will downconvert with no customer impact, the reverse is not true.

Peter Douglas, vice president of operations and engineering at TCI, Littleton, CO.

Our customers (audience) now consist of some combination of people who, at one extreme, have not adjusted anything on their set since 1976 and think all skin tones are green and, at the other extreme, will shell out thousands simply to get the latest connection for their DVD player. HDTV or DTV will not force a tremendous change in the market makeup any time soon. Simply put, there are people who are hardware driven and people who are not. Quality issues will not substantially drive the marketplace. Remember the incredible changes and businesses that were spawned by the introduction of VHS tape equipment? Not exactly a quality enhancement.

Because the majority of the ATSC DTV listed formats are not HDTV, local providers have many options to comply with DTV, but the only way to keep the "H" in HDTV is to use 1,080. ■

Analog resolution

BY MICHEAL ROBIN

TV system design takes as a reference the visual acuity of the eye. Human visual acuity is measured as the angle subtended by the smallest visible detail in an object, which is approximately one minute of arc. The extent to which a picture medium, such as television, can reproduce fine detail is expressed in terms of resolution. Resolution is equal to the number of alternately white and black horizontal lines that can be resolved vertically over the full height of the TV screen and is expressed in lines per picture height (LPH).

What we see is determined by the rod-and-cone structure of the eye and depends on the brightness level and the contrast ratio of the image. The 525/60 and 625/50 scanning standards were developed taking into consideration the visual acuity of the eye, assumed viewing condition in the average home (viewing distance six times the picture height) and transmission-spectrum-savings concerns. Figure 1 illustrates the concept of visual acuity. The relationship between the number of picture elements that can be resolved given a specific picture height and viewing distance is given by:

$N_V = 1/\alpha n$

where

N_V = Total number of elements to be resolved in the vertical direction

α = Minimum resolvable angle of the eye (in radians)

n = D/H (viewing distance divided by picture height)

Given α = one minute of arc or 2.91×10^{-4} radians and n = 6, we have $N_V = 1/(6 \times 2.81 \times 10^{-4}) \approx 572$ lines

This ball park figure is the origin of the number of lines specified for the two conventional TV systems, namely, the 525-line system used in North America and Japan and the 625-line system used elsewhere in the world. The actual resolution is smaller than 525 or 625 lines for reasons explained later in this article. High-definition TV standards with 1,125 or 1,250 lines per picture require shorter viewing distances (e.g., n = 3) for the same picture height as for conventional TV systems or larger screen sizes (e.g., two times the conventional screen size) to enable the eye to resolve all available picture details. Failure to meet these requirements for HDTV displays will result in viewers being unable to appreciate the increased resolution.

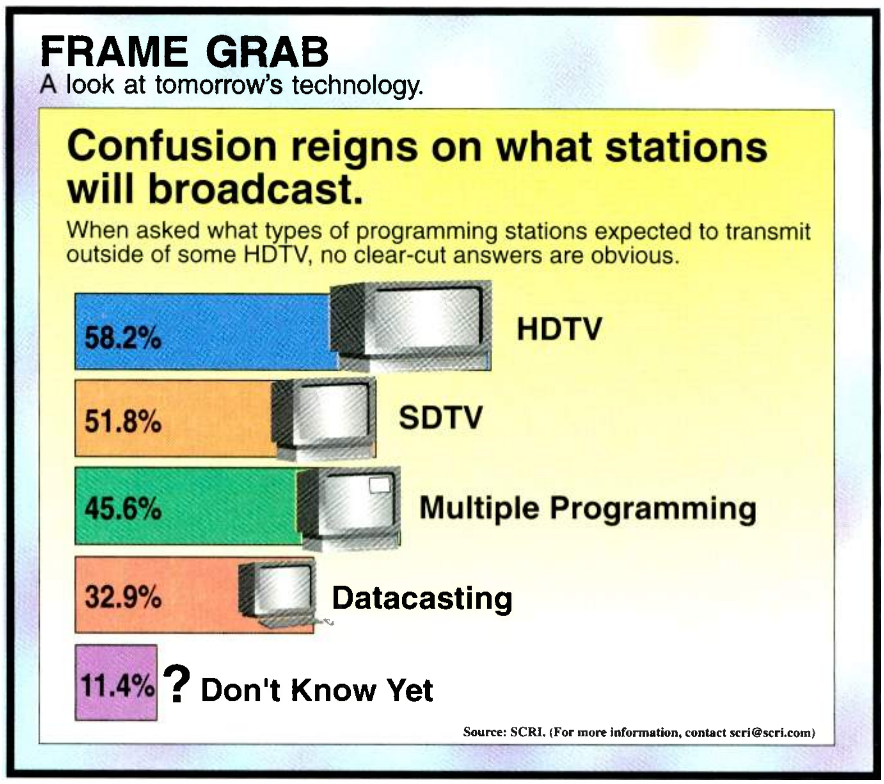
When viewing color images, the visual acuity depends on the color. The acuity for blue and red is about 75% of that for a white image of the same brightness. The acuity for green is about 90% of that of the white image of the same brightness.

The resolution concept

Historically, resolution was understood to mean "limiting resolution," or the point at which adjacent picture elements of an image cease to be distinguished. Various disciplines measure and specify resolution differently. Resolution can be specified as:

- The number of units (i.e., lines or line pairs) per unit distance along the vertical and horizontal axis, such as lines per inch.
- The number of units (i.e., lines) for a full display, such as the lines per picture height (LPH).

In television, the resolution is specified in terms of LPH. The various conventional TV systems in use today were designed to achieve equal horizontal and vertical resolution, better known as *square pixels*.



Vertical resolution

Vertical resolution is independent of the system bandwidth and defines the capability of the system to resolve horizontal lines. It is expressed as the number of distinct horizontal lines, alternately black and white, that can be satisfactorily resolved on a TV screen. Vertical resolution depends primarily on the number of scanning lines per picture and the combined effects of the camera pick-up sensor and the CRT scanning spot shape and size.

Ideally, vertical resolution is equal to the number of active lines per picture, but this only happens if the scanning lines are centered on the picture details. However, the scanning lines cannot be assumed to occupy a fixed position relative to vertical details at all times. A complete loss of vertical resolution occurs when the scanning spot straddles picture details. (See Figure 2.) The situation is further complicated by the interlaced scanning process used by the conventional TV standards. Although it is theoretically possible to assign different brightness values to adjacent lines of consecutive interlaced fields, this results in a severe interline flicker (sometimes referred to as twitter), which renders the vertical resolution useless.

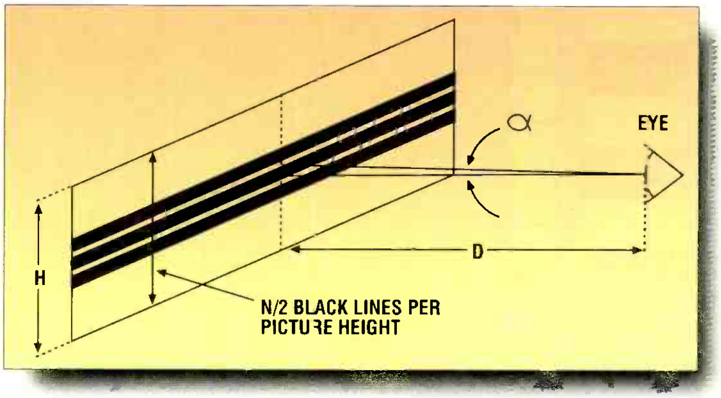


Figure 1. The concept of human visual acuity is based on the smallest visible detail in an object, typically on the order of one minute of arc.

From subjective data it has been found that the number of raster lines must exceed the number of elements to be resolved. This can be expressed by:

$N_V = kN_{AL}$

where

N_V = Number of active vertical picture elements (pixels) to be resolved

N_{AL} = The number of active lines (excluding lines formed while the beam is returned to the top of the picture).

k = Constant obtained from subjective measurements. This is called the *Kell factor* and is usually taken as 0.7 for interlaced TV pictures.

In the 525/60 scanning standard there is a total of 525 lines per frame, of which about 40 are blanked, leaving about 485 active lines per frame. Given a Kell factor of 0.7, the effective vertical resolution of the 525/60 scan-

ning standard is:
$N_v = 0.7 \times 485 \approx 339$ LPH

In the 625/50 scanning standard there is a total of 625 lines per frame, of which about 50 are blanked, leaving about 575 active lines per frame. Given a Kell factor of 0.7, the effective vertical resolution is:
$N_v = 0.7 \times 575 \approx 402$ LPH

Horizontal resolution

Horizontal resolution is directly related to the system bandwidth and defines the ability of the system to resolve vertical lines. It is expressed as the number of distinct vertical lines, alternately black and white, that can be satisfactorily resolved in three-quarters of the width of a TV screen (assuming a 4:3 picture aspect ratio). Horizontal resolution depends on the combined effects of the camera sensor and the CRT scanning spot dimensions, as well as the high-frequency amplitude and phase response of the transmission medium. A system with a 4:3 aspect ratio, as in conventional television, needs to allow for (4:3) Nv horizontal pixels to be resolved. In the 525/60 scanning standard this results in $339 \times (4:3) \approx 452$ horizontal pixels.

Due to the Gaussian shape and finite size of the camera tube scanning spot, a beam exploring a pair of contiguous white-and-black pixels (line pair) results in a sine wave with a positive half-wave corresponding to a white pixel and a negative half-wave corresponding to a black pixel. (See Figure 3.) A beam scanning a picture made up of 452 horizontal pixels results in an electrical signal with 226 complete cycles during the active horizontal scanning line. A similar situation is encountered with CCD sensors and is due to the anti-aliasing filters used in the sampling process.

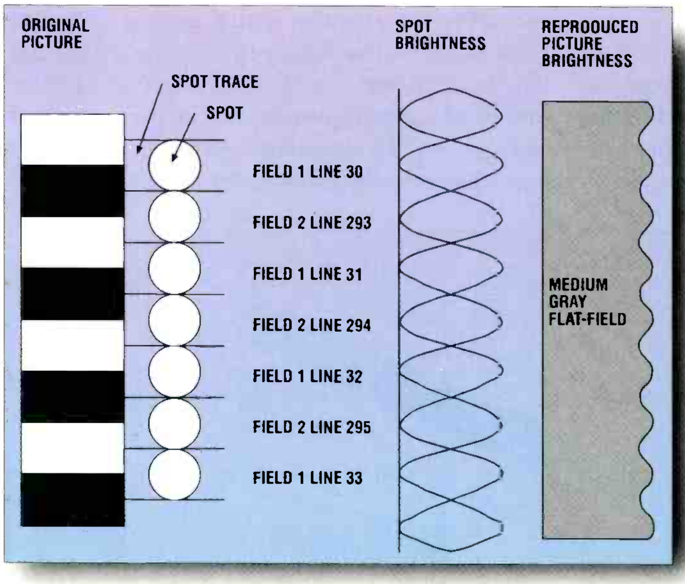


Figure 2. Loss of vertical resolution resulting from the scanning spot straddling the picture details.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In the 525/60 scanning standard the total line duration is 63.5µs and the horizontal blanking duration is 10.7ms, resulting in an active line duration of 52.85µs. The duration of a single cycle is:

$T = 52.85\mu s/226 \approx 0.2338\mu s$

The fundamental frequency resulting from scanning 452 horizontal pixels is:

$F = 1/T = 1/(0.2338\mu s) \approx 4.28MHz$

This is the transmission bandwidth required for equal horizontal and vertical resolution. The horizontal resolution factor for a 4.28MHz bandwidth is:

$339/(4.28MHz) = 79.2$ lines/MHz

In countries using the 525/60 scanning standard (CCIR M), the maximum transmitted baseband video frequency is 4.2MHz, resulting in a transmitted horizontal resolution of:

$N_H = 4.2MHz x 79.2$ line/MHz ≈ 333 lines

The resulting horizontal vs. vertical resolution ratio is, therefore, $333/339 \approx 0.982$. From an analog point of view this represents a quasi-square pixel.

The minimum video bandwidth for equal horizontal and vertical resolution in the 625/50 scanning standard is 5.15MHz and the resulting horizontal resolution factor is 78 lines/MHz. Various countries have adopted different maximum transmitted baseband video frequency values resulting in different horizontal resolutions. In the dominant 625/50 transmission standard (CCIR B,G) the maximum transmitted baseband video frequency is 5MHz resulting in a transmitted horizontal resolution of:

$N_H = 5MHz x 78$ lines/MHz ≈ 390 lines

The resulting horizontal vs. vertical resolution ratio is, therefore, $390/402 \approx 0.97$

Using the same approach, let's calculate the parameters of an HDTV 1,125/60 interlaced TV system. In this system, the number of lines per frame is 1,125 and the number of active lines is equal to 1,035. Given a Kell factor of 0.7, the effective vertical resolution is:

$N_V = 0.7x1035 \approx 725.$

Given the HDTV aspect ratio of 16:9, the number of horizontal pixels required for equal horizontal and vertical resolution is $725x(16:9) \approx 1283$. This results in $1283/2 = 641.5$ complete cycles during the complete horizontal scanning line.

In the 1,125/60 scanning standard the total line duration is 28.448µs and the horizontal blanking duration is 2.586µs, resulting in an active line duration of 25.858µs (nominally 25.86µs). The duration of a single cycle is:

$T = 25.86\mu s/641.5 \approx 40.31ns$

The fundamental frequency resulting from scanning 1283 horizontal pixels is:

$F = 1/T = 1/40.31ns \approx 24.8MHz$

This is the transmission bandwidth required for equal horizontal and vertical resolution of an 1,125/60 interlaced HDTV system. The horizontal resolution factor for a 24.8MHz bandwidth is:

$725/(24.8MHz) \approx 29.23$ lines/MHz

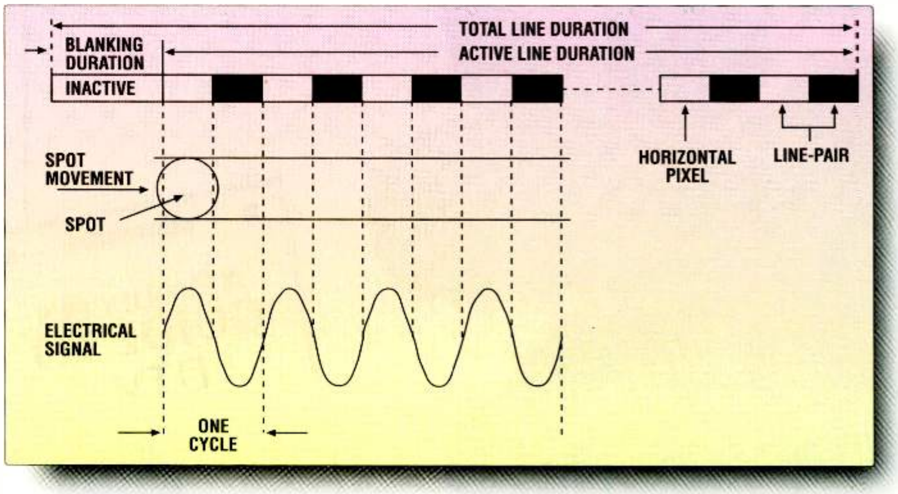

Figure 3. The concept of horizontal resolution is directly related to system bandwidth, and depends, in part, on the camera sensor and size of the scanning spot.

Bandwidth considerations

All calculated minimum signal bandwidths are for a monochrome (luminance) signal or for three wideband chrominance (green, blue and red) signals. Transmission bandwidth savings, as well as monochrome compatibility concerns, have resulted in the NTSC and PAL frequency-division-multiplexing color TV concepts. The chrominance information is inserted into a 4.2MHz or 5MHz luminance spectrum using a quadrature-modulated suppressed subcarrier to transport two color-difference (B-Y and R-Y) reduced bandwidth (about 500kHz) chrominance signals. The resulting composite video signal requires wideband (8MHz) studio signal distribution capabilities to reduce the accumulated linear distortions associated with complex, multiple re-entry, signal distribution patterns. Eventually, these patterns affect the picture resolution and the color rendition. In studio environments the bottleneck is the analog videotape recorder. Analog VTRs have limited bandwidth and contribute most of the multigeneration-related signal degradations. Analog HDTV signals are not encoded in a manner similar to NTSC/PAL and, therefore, require a tri-level (green, blue and red) wideband (30MHz) studio distribution capability, which is costly and impractical.

Digital signal processing, distribution, recording and transmission offer solutions, as well as challenges to achieve a constant picture resolution unaffected by the complex signal distribution patterns. The user-chosen picture quality level is solely determined by the analog-signal digital-sampling parameters, namely the sampling frequency and the number of bits per sample. ■

Micheal Robin, former engineer with the CBC engineering headquarters, is an independent broadcast consultant in Montreal, Canada. He is a co-author of "Digital Television Fundamentals," published by McGraw-Hill.

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The great debate: Novell vs. NT

BY BRAD GILMER

For many years, Novell and Microsoft have been going toe-to-toe, battling for their share of the server software market. Lately, the battle has heated up, with both companies making claims and counterclaims. This month, we will take a look at the two systems.

File services

When you install a file server, one of the first things you might do is log in from a desktop computer (client) and look for the server's disk drives using a file utility. Remote directory services and remote file storage are two basic functions supported by file servers, allowing files to be stored on a common drive that others can see. For example, you can store a text document on a server that your coworkers can share. Your computer treats the file on the server as if it is stored locally.

Print services

Print servers allow users to share a printer. Typically, companies may put less-expensive printers on their desktops, but provide a more expensive shared network printer. To access the printer, users log on to a file server and select the desired printer. From that point on, the print process is the same as if the printer was connected to their desktop machine, with one notable exception. Instead of printing directly to a printer, users print to a queue. If someone else has put a big print job in the queue before you, then you will have to wait. If someone put a file in the queue that causes the printer to crash, the print queue manager may be used to clear the offending print job so your job will print.

Application services

Application servers run software that is designed using the client-server model. In these systems, the server runs some of the application. Client-server technology is most often used in database applications. Client-server applications are written so that the client (your desktop computer) requests information from the server, or it requests that particular calculations or procedures be performed. The server makes the requested calculations and returns the results to the client. Client-server applications require that the program on the server and the client be closely linked.

Other types of servers available include fax servers, E-mail servers and so on, but file, print and application servers are the most common.

Microsoft NT	Novell
Better at application services	Better at file and print services
Easier to install and maintain for people who are comfortable with GUI interfaces	More hands-on installation and maintenance for people who like to get "under the hood"
Integrated with other Microsoft applications, such as Windows NT and the SQL database	Provides a heterogeneous environment without strong ties to the desktop
Web server and development tools packaged with the server software. Domain Name Server included in package	IntranetWare product provides web services
Support for IP protocol is native to the product	Primary protocol for the product is IPX/SPX. IP protocol is also supported
Automatic recovery from errors in file system	Vrepair (Volume Repair) tool allows recovery from errors. Some automatic recovery from errors
Wizards simplify server administration. But some say that the wizards get in the way	Server administration tools are comprehensive, but lend themselves to people who like to get "under the hood"
Domain structure can be restrictive in some environments	Novell Directory Services allow network resources to be grouped according to function, location or organization structure. Allows use of these resources without having to know where resource is
Cost of ownership can be lower than Novell under some circumstances	Cost of ownership can be lower than NT under some circumstances

Table 1. Comparison of key features between NT and Novell.

The comparisons

Table 1 compares some of the key features of NT and Novell. However, you should also do your own research. Performance comparisons of the two systems is not done, because performance can vary greatly with network configuration, application, number of users and other variables. Many popular computer magazines have run benchmark tests on the two systems — check them for the latest figures. Also, I only compared existing products. NT 5.0 is due to ship soon, and it has capabilities that are not discussed here.

Generally, Novell is strongest in the area of traditional file and print services, while NT has the upperhand in application services. Novell concentrates on the server environment, while Microsoft closely integrates the server with the desktop operating system.

Use in the broadcast environment

Generally, you will see these two systems implemented by vendors according to their strengths. NT frequently is used in automation systems and in some video file servers because of the strong database orientation of these products. Novell is frequently used as a central server in products that provide shared

file access, such as the graphics and post-production environment.

One does not fit all

In the end, the system you choose will be based partially on cost, partially on performance, partially on the philosophy of the server manufacturer and partially on personal preference. There is no one right server for everyone. ■

Brad Gilmer is president of Gilmer & Associates Inc., a technology and management consulting firm.

For further reading:

The following web sites are dedicated to presenting comparative information on the two systems. They are biased, but at least you can get information from both ends of the spectrum and can then make your own decision. Interestingly, this is the one topic where I have had a problem finding neutral web sites. It seems that everyone has a point of view.

- A Novell site containing competitive comparisons between Novell NetWare and Microsoft NT can be found at: http://Netware.Novell.com/discover/compete/camsnt.htm
- A Microsoft site containing competitive comparisons between NT and NetWare can be found at: www.microsoft.com/ntserver/comparisons/withnetware.asp?A=4&B=3

For a wealth of information on networking in general and Novell topics in specific, check out: *Novell Networking Primer - What is a Computer Network?*

Through a series of primers, the web site covers everything from an introduction to networking to an extremely thorough glossary to in-depth discussions of building networks, complete with illustrations. Example primers:

Important WAN and High-Speed Technologies.
www.novell.cz/produkty/bguide/primer/primer5.html
www.novell.cz/produkty/bguide/primer/primer5.html

The network operating system.
www.novell.cz/produkty/bguide/primer/primer3.html
www.novell.cz/produkty/bguide/primer/primer3.html

Glossary of Novell and networking terms.
www.novell.cz/produkty/bguide/glossar.html
www.novell.cz/produkty/bguide/glossar.html

If you need reference books on networking, consider these:

- The Novell Certification Handbook, by Robert Williams, John P. Mueller, 2nd Edition. Published by Computing McGraw-Hill.

Ideal for the growing number of network specialists interested in Novell certification.

- Windows NT Server: Professional Reference, by Karanjit S., Phd Siyan. Published by New Riders Publishing.

Written for intermediate and experienced users, this book cuts through the redundancy and entry-level discussions found in many other Windows books. The included CD-ROM contains shareware, product demos and working models.

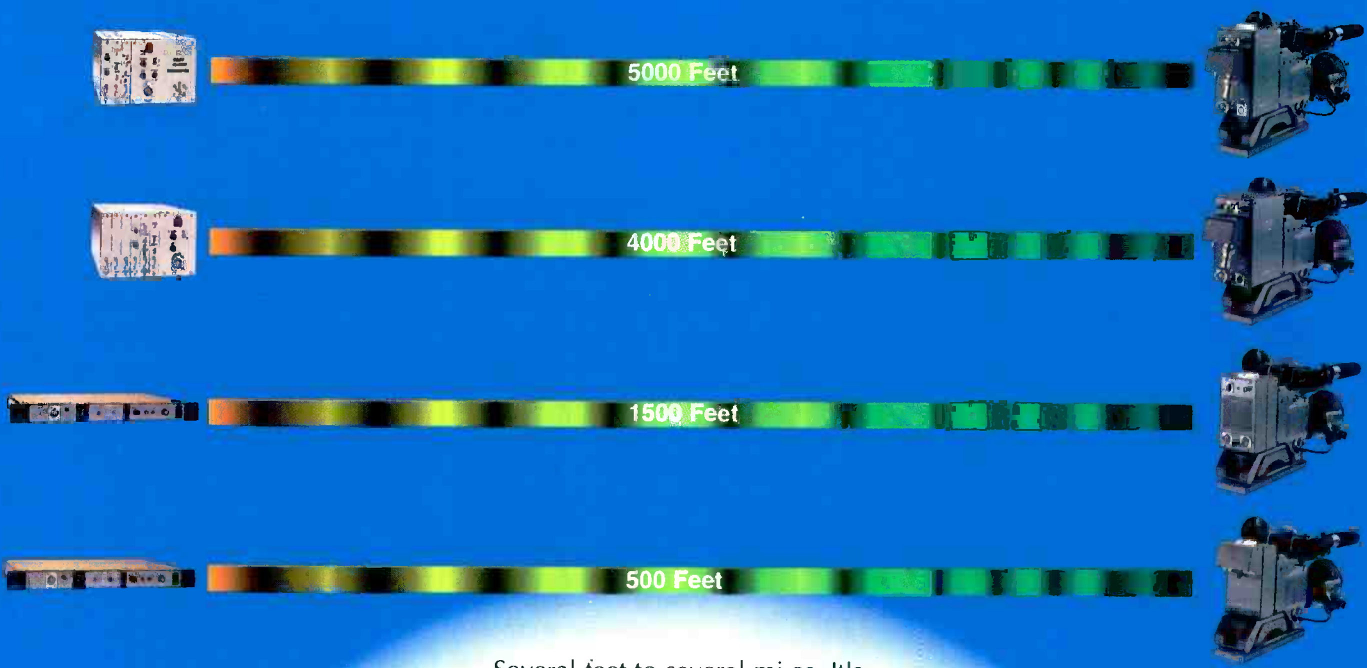
- Mastering Windows NT Server 4, by Mark Minasi, Christa Anderson, Elizabeth Creegan. Published by Sybex.

Just released. According to reviewers, if you use NT Server you need this high-level, irreverent, readable discussion of essential operations, undocumented features, secrets and walkarounds of Windows NT Server 4.

- Novell Cne 3 Resource Library, by Doug Archell, Dorothy Cady, Peter Kuo, Debra Niedermiller-Chaffins. Published by New Riders Publishing.

This tutorial covers the certification requirements for CNE exams. In addition to the tutorials, readers can review numerous test questions that enable them to evaluate their readiness for the Novell examinations. ■

Telemetrics Goes The Distance.



Several feet to several miles. It's the range of distance Telemetrics delivers to turn your ENG cameras into full featured EFP cameras for the field and the studio. With direct docking camera adapters -- factory set-up ready to plug and play. And the compatibility to interface with virtually any video format including digital. It's the level of performance you would expect from the people who invented triax and coax camera control technologies.

For composite video, there's the Telemetrics TM-9250 triax system. It maintains signal integrity over the longest cable runs (5000 feet*). And offers comprehensive camera set-up and adjustment capabilities, along with video, return video, microphone audio, intercom, tally, and genlock -- plus power. It's the industry standard for quality and performance. For component video, Telemetrics' TM-9660 Triax System offers all the same functionality. With all the benefits of component video transmission to a distance of 4000 feet.

If you're working with coax, the Telemetrics TM-9255A Coax System delivers cost-effective camera remote control capabilities at distances of 1500 feet. Plus power for the camera and a large studio viewfinder. Telemetrics also offers the TM-9525 Dual Coax/Fiber System. This highly versatile system employs dual coax cables up to 500 feet and can be cost-effectively interfaced with 15MHz unidirectional fiber optic transceivers for long distance camera control without the use of repeaters.

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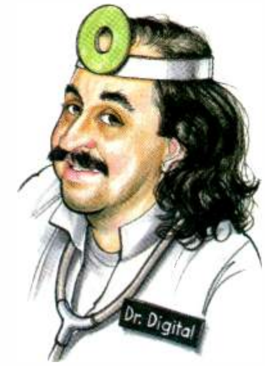

Found: 1 diascope

BY STEVE EPSTEIN, TECHNICAL EDITOR

It seemed no sooner than the January issue hit the streets, I started receiving mail. One of the first letters was from Andy McGuire. It seems he was trying to set up an Ikegami HK-366 "by the book," and needed an external diascope. By the book, huh? Thankfully, those Japanese manuals have gotten better over the years. I remember when you had to start at the back of the book and move forward, the procedures were out of order, with the first procedure last and the last procedure first, but I digress...

I contacted Bob Estony, Ikegami's communications manager, at its U.S. headquarters in Maywood, NJ, (201-368-9171). Shortly after we spoke, Bob called me back to let me know that the external diascope referred to in the manual was sold with the camera as an option. It is the CPU-300 chart and comes with a list price of $1,340. I relayed the info to Andy and a few days later I received the following:

Thanks for the help. You got me the only real answer after many hours of searching.

Andy McGuire

In *Broadcast Engineering's* 1998 *DTV Buyers Guide*, *BE* readers gave 20 new products a Reader Pick award. (If you missed them, they start on p. 79 of the *Buyers Guide*.) Among the winners was a set of educational tapes offered by Sony Electronics. Bill Katrina at Katrina-Metrocon Engineering Technologies writes:

I have been looking for the five-volume tape set, *Sony Media Forum* educational series. It won a Reader Pick award in the 1998 *Broadcast Engineering DTV Buyers Guide*. Could you help me with a contact at Sony so I could procure this set?

W.G. Katrina, P.E.
Katrina-Metrocom Engineering

Sony responds:

We are very proud that the Media Forum video series was chosen to receive *Broadcast Engineering's* Reader Pick award. The series covers tape handling, troubleshooting and the fundamentals of magnetic tape, recording and broadcasting. Each of the seven videos addresses a specific topic, including two new titles, "Television: Delivering the Magic" and "Transforming Color: Composite to Component Video." Anyone interested in purchasing one or all of the videotapes can call 800-955-SONY.

Joseph Tibensky
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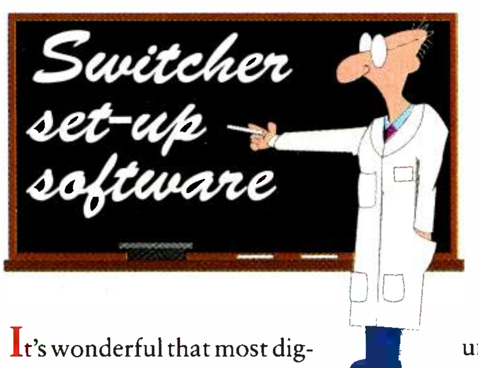
Steve Epstein



It's wonderful that most digital production switchers and some of the higher-end analog switchers have auto set-up routines, but there are a lot of older analog switchers still in use that do not. Just last week I saw an ad in the Kansas City newspaper looking for a technical type who knew how to operate a variety of video equipment including a GVG 1600. At the last station I worked at, after moving into our new facility, we dragged the production switcher from the old building over and put it in a back edit suite. It was an old ISI unit with two M/Es and a program/preset bus. It was in serious need of an alignment. Video levels and phase were different on each bank and something had to be done before it could be put back in the signal chain.

If you've ever aligned a switcher, you know the drill — find someone to sit at the switcher and rock the lever arm while you sit at the electronics and align each of the switcher cards. This can take hours and it is really not much fun for your assistant. Years ago, I remember meeting a Grass Valley technician who came into our facility to work on an old 1600 — he had an M/E control panel in a briefcase. He plugged it in an was able to do each bank while he was standing at the rack-mounted electronics, what a nice way to go. But, back to the ISI at hand. I really hated to tie up two people for several hours on this project and at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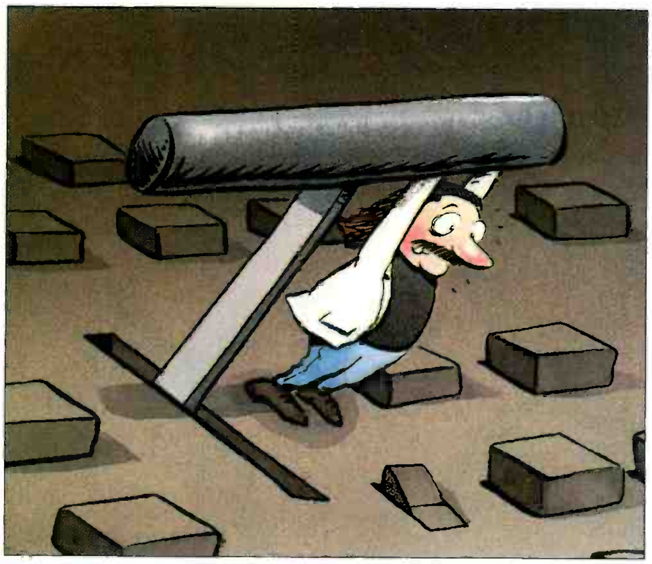
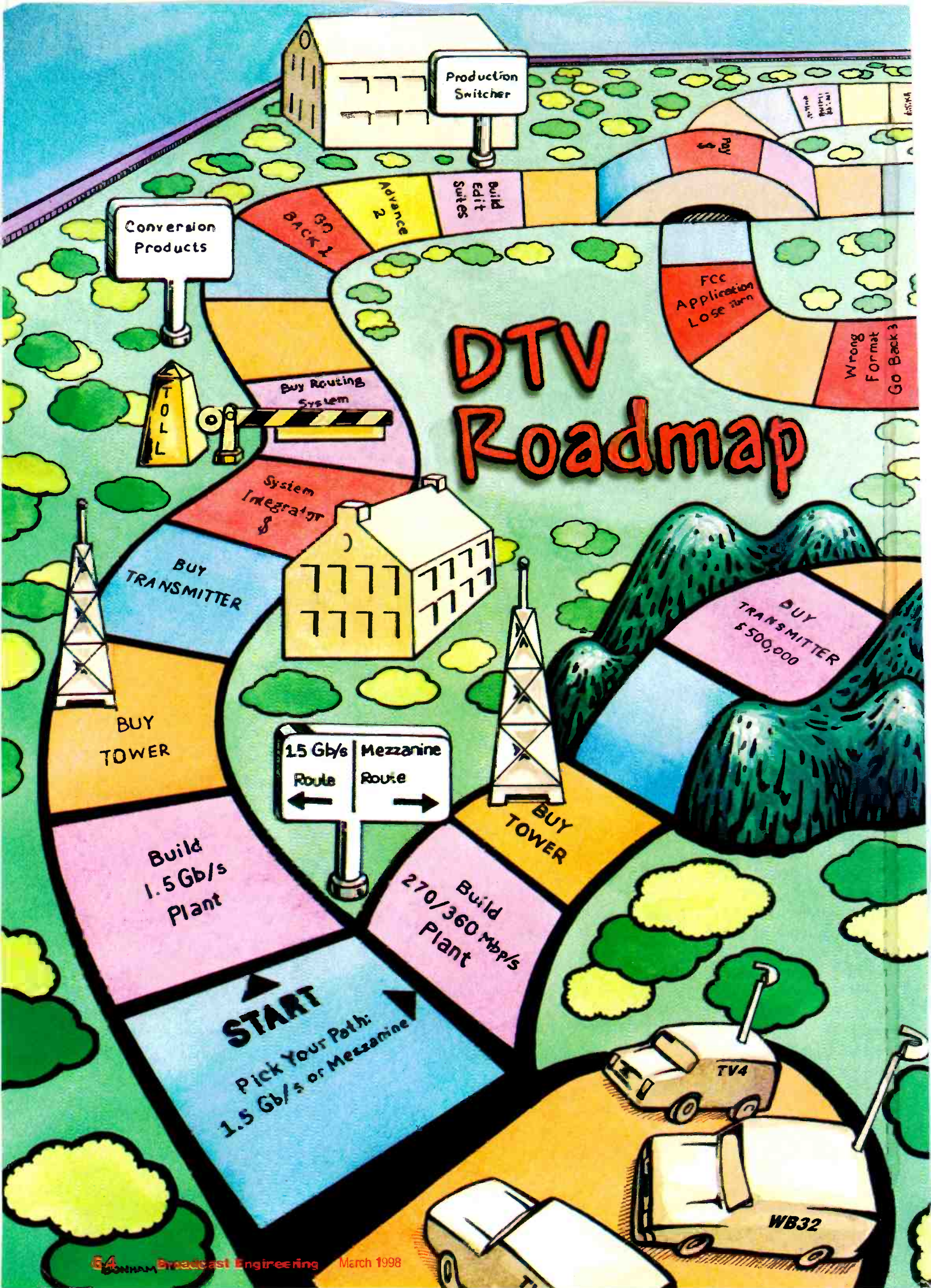
the time, I was doing some assembly language programming and thought maybe there was a way around this dilemma.

The switcher had a serial input for editor control and our shop computer was tied into an RS-422 patch panel. We had used it for rudimentary machine control and troubleshooting so it was a simple matter to tie it into the ISI's control port. I obtained the control protocol from ISI (it turned out to be GVG 1600 protocol) and proceeded to write a simple assembly language program to control the switcher. Every 1.2 seconds the program commands the switcher to do a 30-frame dissolve and does so for 500 repetitions. The program runs in DOS (it's only 600 or so bytes long) and can run on about any PC (even old XTs) with a COM port. Once it is running, the switcher dissolves between whatever crosspoints are set on the appropriate M/E bank and continues to do so for about 10 minutes. During that time, it is a simple matter to make the necessary electronic adjustments.



With the proper test and monitoring equipment it is easy to "null" the differences between the banks as the "auto-transitions" are taking place. When you no longer see changes on the scopes, either the banks are properly adjusted or you've exceeded the 10-minute time limit. Because the program does not choose the crosspoints, it is easy to change them midstream if you need to look at black and black instead of bars and bars or whatever. As you move down through the switcher the re-entry points can also be checked quickly and easily.

Like most software projects, it took more man-hours to write the software than it would have taken to align the switcher. However, over time, the software proved its worth repeatedly as it allowed efficient monthly touch-up alignments. If you've got an old switcher that runs on a GVG 1600 protocol and would like a copy of the program, let me know and I will E-mail you a copy.


DTV Roadmap
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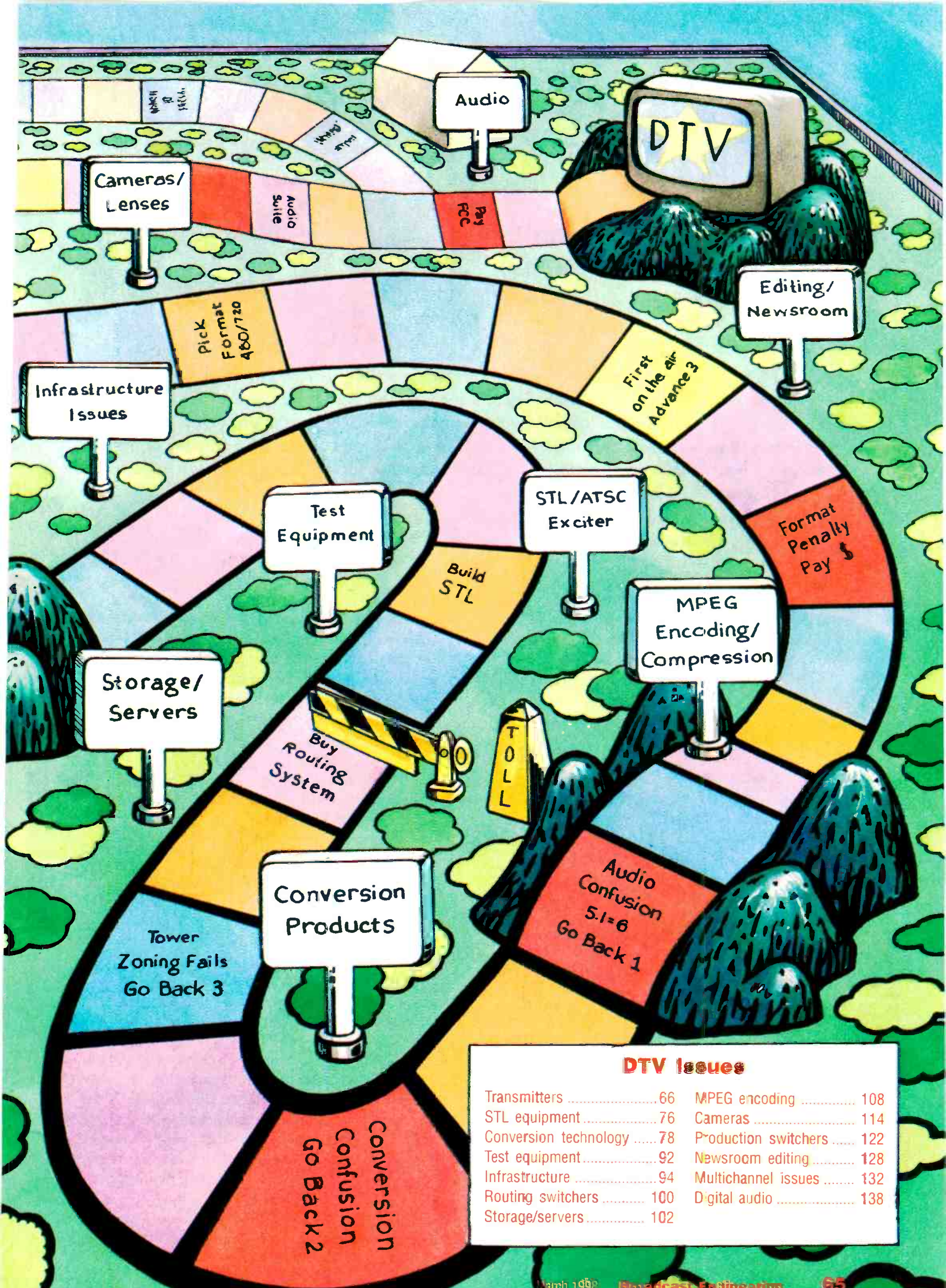
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DTV Issues

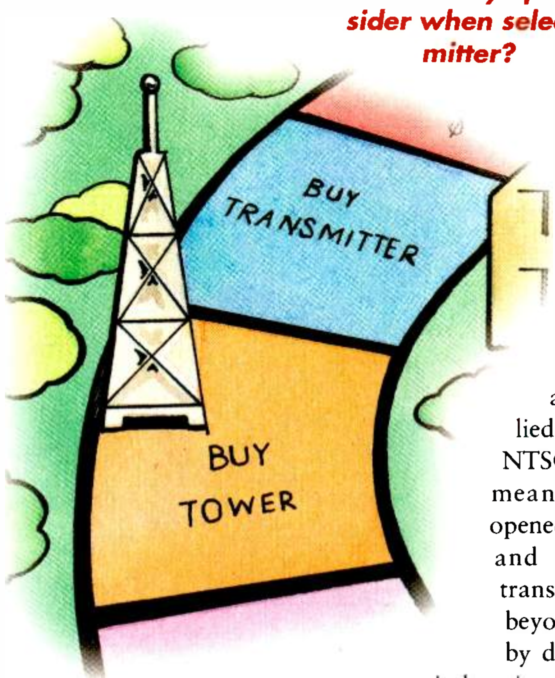
The road to digital

The FCC has determined the rules and the timetable for DTV. Many of the stations have "volunteered" to be on-the-air with digital signals by the end of this year or early next year. Despite this, much of the equipment required is either unavailable or in prototype. Many of the decisions required to implement DTV remain undecided. In an effort to bring many of the core issues to light, *Broadcast Engineering* magazine has assembled a team of experts and posed some fundamental questions.

The questions and the various answers follow. Use them as a guide when discussing DTV technology with the various vendors on this year's NAB show floor.

Question:

Besides frequency and total power output, what are the key specifications to consider when selecting a DTV transmitter?



By Howard G. McClure

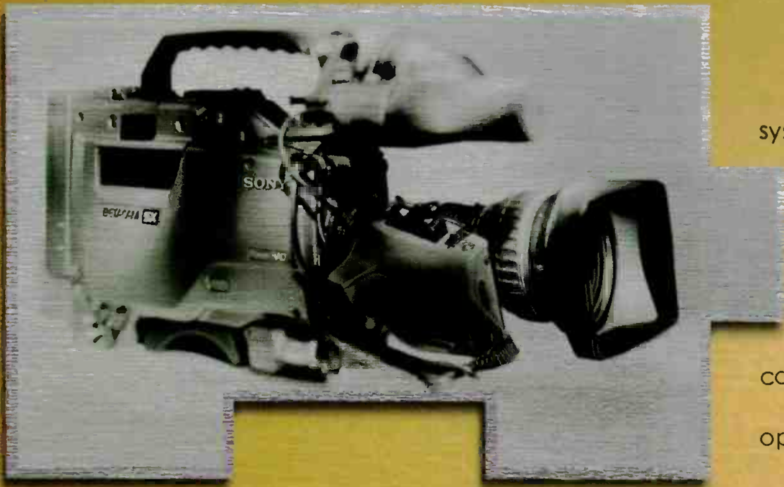
Howard G. McClure is vice president of North American operations for Itelco USA Inc., Westminster, CO.

Many of the characteristics we have relied upon to choose an NTSC transmitter are now meaningless. DTV has opened a new book of terms and specifications. The transmitter of 1998 and beyond is mostly designed by digital engineers, making it difficult for those of us who are trying to migrate to the new digital world. The traditional transmitter designers are no longer leading the industry; the high-tech digital-oriented companies now offer features and benefits not realized as possible in the recent past.

Today, cost of ownership (purchase cost, operating cost, maintenance cost and reliability) has to be the number one deciding factor in the purchase of a transmitter. With the expense of operating two stations on the income of one, the traditional "I will buy another one of these because I know it works," may not be the best answer for this new digital world. In this new world, power alone is not what will predict your coverage, any factor that increases bit error rate (BER) will reduce your coverage. Therefore, simple characteristics like local oscillator frequency and phase stability may impact your coverage even though you are producing your authorized power. Other factors that could impact your coverage like group delay and amplitude response are more commonly understood, but can be impacted by other components of the transmission facility like the antenna and transmission line. Linearity of the amplifiers following the digital modulator is of the utmost importance, but the new digital precorrectors can correct for non-linearities found in solid-state and IOT amplifiers.

> **DTV transmitter purchaser's check list:**
> - Cost of ownership.
> - Quality of product and company.
> - Technology presented.
> - Diagnostics capability.
> - Digital transmission experience.
> - Single source of product development and production.
> - Availability of multiple sources for devices used in the transmitter.

With the advent of DTV and the declining presence of station-level RF expertise, the need for high-quality diagnostics by local and remote access is no longer a "want," but a necessity. On-site repair of the digital components of a DTV transmitter is near to impossible. So, the first requirement is



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dtv READY

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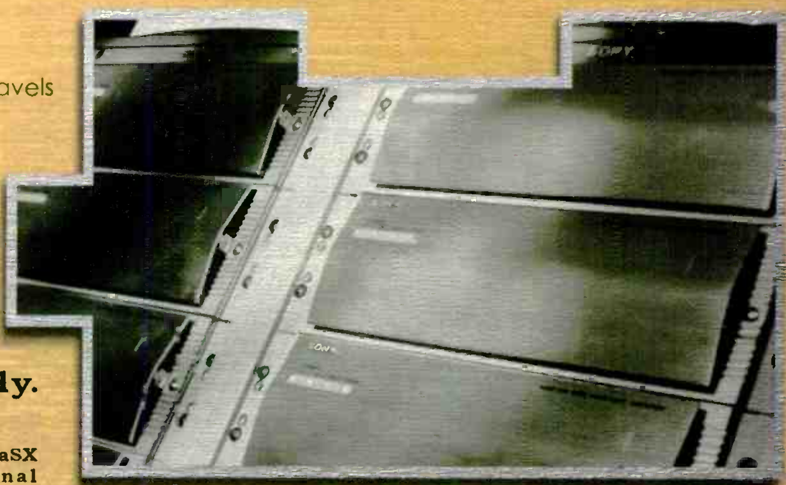

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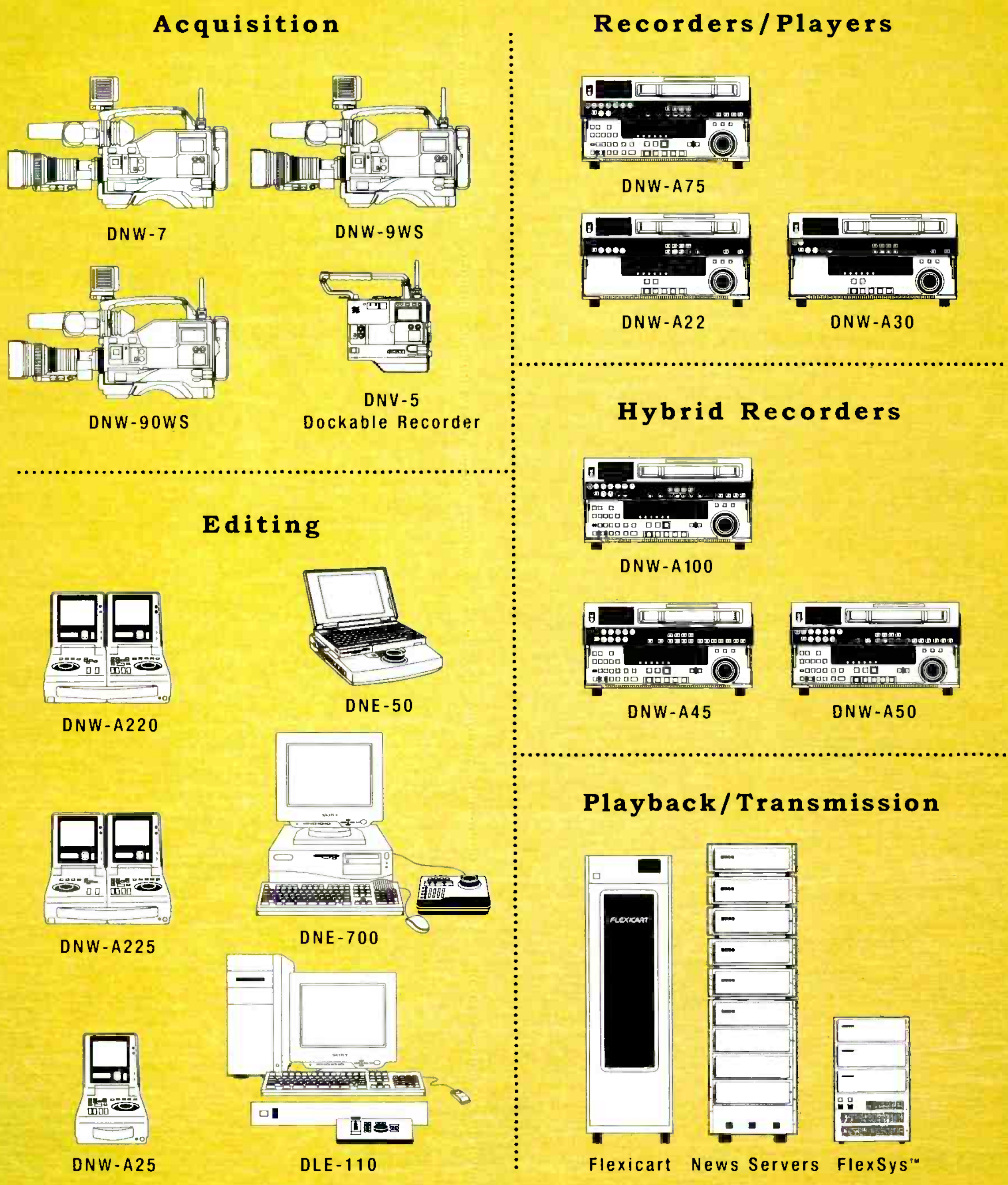
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a backup system or parallel component, i.e., dual exciter and parallel amplifiers, then a comprehensive diagnostics system that can be shared through remote access with the transmitter manufacturer to effect a speedy correction to any transmitter fault. It is most likely that equipment failures in digital transmitters will be cured by substitution of a circuit board assembly through an exchange program with the transmitter manufacturer. If the manufacturer has access to your transmitter via modem, the company can assist in the diagnostics and ensure the correct assembly is available for your transmitter repair. This requirement for a cooperative partnership between transmitter owner and transmitter manufacturer will mean that the manufacturer will have to be in total control of his product to ensure compatibility and exchangeability throughout the transmitter's life cycle. This can best be assured by a manufacturer who has the manufacturing procedures in place that are assured by an IOS 9001 or higher certification.

By Robert R. Weirather

Robert R. Weirather is director, TV product line for Harris Corporation, Broadcast Division, Quincy, IL.

There are many key DTV transmitter specifications to consider to ensure proper operation of your DTV facility. Your first concern is whether the transmitter meets requirements set forth by the FCC. Although these requirements seem to be somewhat simpler than those for NTSC operation, frequency, spectrum occupancy and power output are of interest to the FCC. Once you ensure that the transmitter meets FCC requirements, there are five other specifications you may want to consider:

Interfaces: We must have compatible interfaces between the digital source of MPEG-2 and the exciter. That interface, defined by SMPTE 310M, ensures compatibility between the exciter and the source, which may be the STL or an encoder. Much like NTSC, the transmitter frequency may be required to be locked to precise sources with given offsets. Thus, exciters must be capable of being referenced to precision standards. Note that the input to the exciter is an MPEG-2 bitstream that may come from a local source or from a national network. The output frequency of the exciter must not change whenever the frequency of the MPEG-2 bitstream changes. Additionally, the exciter must react to the loss of the input MPEG-2 bitstream. If this input bitstream is lost, either by STL interruption or other problems, the coding scheme of the exciter must continue to insert sync. This automatic sync insertion without input keeps receivers from unlocking.

Redundancy: The output power capability of the transmitter is licensed by average power. Cliff effect reception implies that the coverage area will be sharply prescribed by signal-to-noise ratio. By maintaining maximum power output, coverage will be maximized. You'll want to ensure your transmitter provides the level of redundancy or headroom needed to maintain maximum power output from the PA. This redundancy for tube circuit finals may require operation of at least two parallel tube PAs. By having twin tube PAs, power output may be fully maintained or at least maintained to half power. Differently, solid-state transmitters typically have numerous parallel path PAs. These types of transmitters suffer less power loss for a given failure.

Signal quality: The quality of the delivered signal must be adequate. Signal quality may be measured by bit error rate, signal-to-noise, error vector magnitude, eye pattern, constellation accuracy and pilot level. Although there are many other signal qualities that may be measured, these are indirectly contained in the aforementioned parameters. These qualities are flatness of response, in-band intermodulation and group delay.

Long-term vs. initial cost: Cost of operation and acquisition must be a part of the decision-making process. Certain transmitter types may have higher operating costs relating to electricity consumption and/or replacement parts. Other transmitters may have lower long-term costs of operation but higher acquisition costs. If labor and maintenance are limited, then a low-maintenance design may be preferred.

Specific installation requirements: Although installation costs, floor space and time may not seem like high-priority items, a station should nevertheless consider its specific requirements. For example, a liquid-cooled transmitter may be more difficult at the top of a large building than at ground level. However, installing a liquid-cooled transmitter at ground level, using out-of-building construction may prove the best choice.

By Dane E. Ericksen, P.E., CSTE, CSRE

Dane Ericksen is with Hammett & Edison, Inc., Consulting Engineers, San Francisco.

Besides the obvious issues of faithful reproduction of the DTV signal and stable operation, DTV transmitter selection should include the following considerations:

Ability to lock to an external NTSC reference: The transmitter should have the ability to lock its frequency to an external NTSC lower-adjacent signal in the event that channel relationship exists, so as to maintain the 5.082138MHz±3Hz frequency offset required by section 73.622 (g) of the new FCC rules. Because NTSC transmitters are allowed a greater frequency tolerance of ±1kHz (even though the actual frequency stability of a modern-day NTSC transmitter is typically an order-of-magnitude better), an upper-adjacent DTV transmitter may need to lock its pilot carrier frequency to the lower-adjacent NTSC signal. This ability to reference an external NTSC signal should accommodate high level (for transmitters that are co-located) and low-level (for transmitters that are not co-located) signals, and should transfer gracefully to an internal frequency reference if the NTSC reference is lost (for example, if the NTSC station signs off the air while the DTV station is still operating). Of course, it may be simpler to upgrade the NTSC transmitter to, say, a ±1Hz tolerance, so that the combined frequency stabilities still result in a 5.082138MHz±3Hz offset, but the ability to reference the DTV frequency to a lower-adjacent NTSC signal should at least be an available option.

Good second and third harmonic attenuation: The transmitter should have second and third harmonic attenuations of at least 80dBc, even though section 73.622(h) of the new FCC rules only requires 71dBc of attenuation for out-of-band signals removed by more than 6MHz from the DTV channel edges. The additional attenuation is needed to minimize the likelihood of interference to GPS at 1,575.42MHz (second harmonic of D66 and third harmonic of D23) and other L-band uses (for example, radio astronomy research in the 1,330-1,727MHz band, which is entitled to protection pursuant to section 2.106 of the FCC rules, footnotes 718, 720, 721 and 722). Protection of GPS is especially important because the FAA has decided that the next generation of instrument landing systems (ILS) for commercial aircraft will be GPS-based. The one point in flight when the ILS must not fail is during landing, yet that is the time of maximum risk, from harmonic radiation and brute-force overload. During the landing approach, the aircraft may be flying through or near the main beam of a DTV antenna. There should also be an option for even greater attenuations for exceptionally difficult cases; since this would typically involve high-powered bandpass or harmonic filters, the DTV manufacturer must be able to provide filters with group delay characteristics that will not harm the DTV signal (or, alternatively, the DTV transmitter must have the capability to pre-distort the DTV signal to cancel out the group delay distortion caused by an added filter).

Ability to pre-distort for group delay errors in the transmission system: The transmitter should have the ability to pre-distort the DTV signal at the exciter or modulator level, to cancel out group delay distortions caused by an adjacent-channel (or otherwise) combiner, bandpass filter, harmonic filter or even a less-than-optimum antenna. This pre-distortion capability would ideally be EPROM-based (or other changeable memory), so that it could be modified in the event the combiner or antenna group delay changes as the result of added stations and modified RF plumbing. The ideal correction system would further have the ability to compensate for the antenna or combiner group delay distortion as the temperature of the combiner or antenna varies, in the event that temperature variation causes a shift in the group delay characteristics.

Scalability: The DTV transmitter or line of DTV transmitters, should offer a wide range of overlapping power levels to accommodate the broadcaster who wants to start out with less than full-power DTV facilities and upgrade later.

This power scalability should not involve the obsolesce of already purchased lower-power transmitters or power amplifiers; that is, the DTV transmitter line should be designed with power upgrades in mind.

Traditional items: The DTV transmitter must be FCC type-accepted or notified; should have good prime AC power to DTV RF output efficiency; be solid-state (where feasible); allow for easy tube replacement (for tetrode, IOT or Diacrode-based transmitters); not require ear protection due to blower of pump noise; have a minimal transmitter cabinet footprint; be designed for easy routine maintenance; have an attractive price; and be immediately available (yeah, right, in my dreams).

Question:

Will stations be able to use RF delivery for STL systems or will fiber-optic solutions be required for DTV signals. Will these new DTV STLs be in addition to or a replacement for existing NTSC STLs?

By Dr. John Payne

Dr. John Payne is president of Nucomm Incorporated, Hackettstown, NJ.

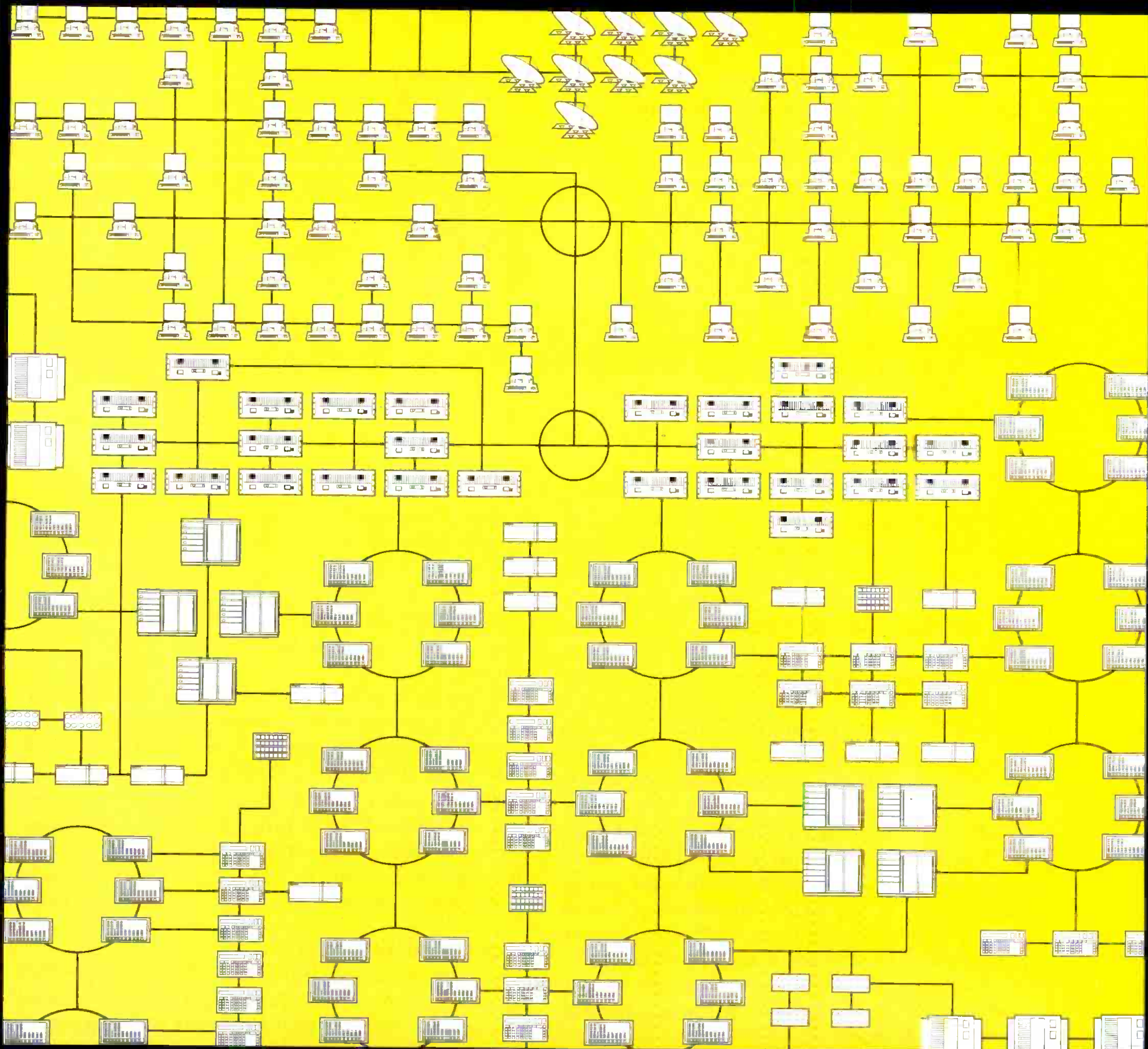
As the deadline for the first phase of HDTV installations in the United States approaches, the consideration of how to transmit NTSC and HDTV signals from the studio to the transmitter is becoming a major issue. There are basically three methods available for this application.

Method 1: Use the existing STL for the NTSC signal and use a fiber-optic line for the HDTV in either the 1.3Gb/s, 270Mb/s or the 19.39Mb/s format.

Method 2: Use the existing STL for the NTSC signal and use a second microwave link to transmit the HDTV 19.39Mb/s transport stream.

Method 3: Use a single microwave link in which NTSC and HDTV signals are multiplexed together.

Method 1, although the simplest and most desirable, is expensive and is open to the fiber line being inadvertently cut. Often, such a service is not available between the studio and the transmitter site. Method 2 is also simple, desirable and cost effective. Its main drawback is the availability of a second frequency. Method 3 requires that the NTSC analog baseband signal be digitized and compressed by an encoder. The encoder's output is then multiplexed with the HDTV



19.39Mb/s transport stream. The resultant transport stream is then transmitted over a digital microwave link. At the receiver end, the digital signal is demodulated and demultiplexed. The NTSC signal is decoded back to an analog baseband signal and feeds the NTSC TV transmitter. The HDTV transport stream from the demultiplexer feeds the HDTV transmitter directly.

Stations will definitely be able to use RF delivery for STL systems for DTV signals as long as we are talking about the 19.39Mb/s or 45Mb/s data. The real question that stations must answer is do they have a second microwave frequency to be used for the DTV signal? If they do have a second frequency, then a digital DTV STL is a simple and reliable solution. The original analog NTSC STL would remain.

If a second frequency is not available (as is the situation with most stations) then a complicated and costly system must be used. Such an RF solution evolves digitally combining the NTSC and the DTV signals into a single transport stream and transmitting it over a single RF link. Such a system must have redundancy. This new STL would then replace the existing STL. It would reuse the existing STL frequency, antenna, feeds and towers.

When designing a new STL to transport DTV and NTSC, the question of redundancy vs. cost must be carefully considered. Is it important to have 100% redundancy for NTSC and DTV signals or only the NTSC? If the DTV signal is lost for minutes, hours or days, is this really important since only a handful of people will be viewing it for the next several years?

NUCOMM has developed RF delivery systems for the single DTV digital signals and dual NTSC and DTV signals. Varying degrees of redundancy are offered that can be gracefully upgraded. Many options are offered to enhance such systems. These include frequency and space redundancy, GPS time-based accuracy and seamless switching.

The following considerations must be taken into account when selecting an STL for a digital microwave system to transmit the HDTV signal:

- System redundancy.
- Redundant system switch-over effects, i.e., seamless switching.
- Relative importance of the downtime of the NTSC vs. the HDTV signal and its effect on system cost and redundancy.
- Frequency and space diversity vs. single-frequency redundancy.
- The use of a GPS time base to reduce jitter on the HDTV signal.

Question:

How long can stations get by with simply installing an upconverter on the front of their DTV transmitter and avoid building a DTV studio facility?

By Micheal Robin

Micheal Robin, former engineer with the CBC engineering headquarters, is an independent broadcast consultant in Montreal Canada. He is a co-author of "Digital Television Fundamentals," published by McGraw-Hill.

There are three distinct aspects to DTV: production, transmission and display. All three aspects are undergoing frenetic concept, component and product development to meet the end-of-1998 start of on-air DTV transmissions. The DTV digital transmission concept allows the broadcaster full flexibility to choose the transmitted video format all the way from HDTV pictures, using the full bandwidth of the standard 6MHz transmission channel, to several simultaneous low-resolution pictures or to use the channel for other services. Given the DTV transmission constraints, a full-definition HDTV picture display in the home is affected by the program source quality and the display characteristics of the home receiver.

The program source quality is directly related to the choice made by the broadcaster. This choice will depend on many factors, some of them having nothing to do with picture quality.

The display characteristics of the home receiver are directly related to the sophistication level of the home receiver. The average non-technically minded viewer will identify DTV, including the HDTV variety, with a large, high-priced, widescreen TV receiver offering ghost-free and noise-free pictures, accompanied by CD-quality surround sound emanating from an impressive array of loudspeakers. The resolution of the picture, while an important factor to technically minded viewers, is a secondary factor to the average viewer.

Program source quality

There are three well-defined 16:9 display aspect ratio picture choices as shown in Table 1. It is debatable whether the interlaced version of the 1,920/1,080/30 format, with a vertical resolution capability of about 756LPH (Kell factor of 0.7), is visually superior to the progressive scan 1,280/720/60 format, with a vertical resolution of about 648LPH (Kell factor of 0.9). In any case, both formats qualify as HDTV and require a superior display device.

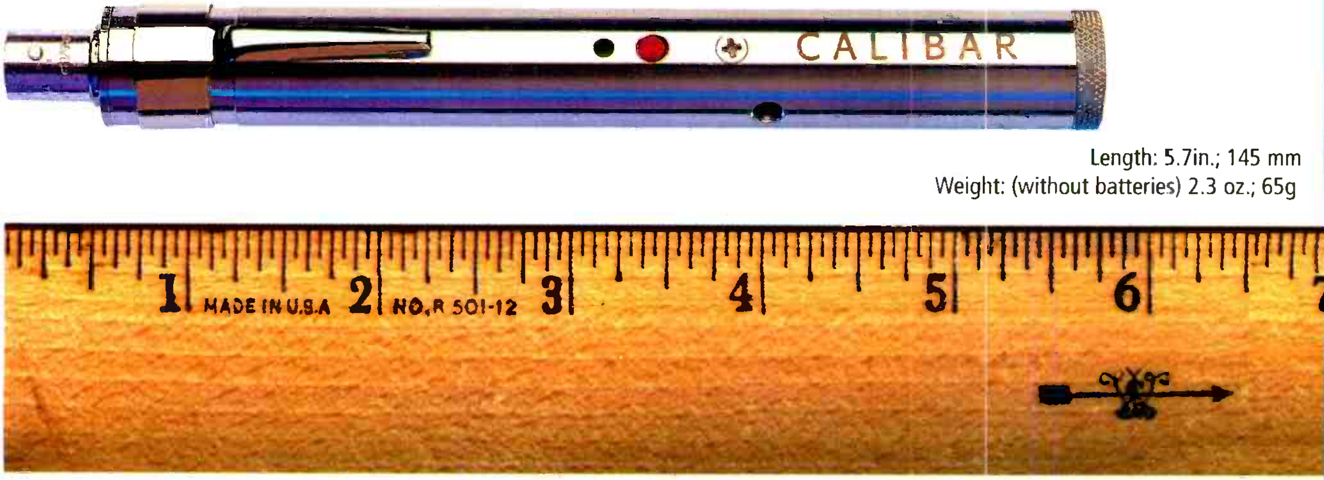
HORIZONTAL PIXELS PER ACTIVE LINE	ACTIVE LINES PER PICTURE	SCANNING	FRAME RATE CHOICE (Hz)
704	480	PROGRESSIVE INTERLACED	60, 59.94, 30, 29.97, 24, 23.98 30, 29.97
1280	720	PROGRESSIVE	60, 59.94, 30, 29.97, 24, 23.98
1920	1080	PROGRESSIVE INTERLACED	30, 29.97, 24, 23.98, 30, 29.97

Table 1. 16:9 picture formats as per ATSC A/53.

Display characteristics of the home receiver

Whatever the program source quality, the perceived picture quality is largely dependent on the home display device and the related viewing conditions. A 4:3 standard-definition 525/60 picture reproduced on a 27-inch CRT with a

The Most Accurate Portable Video Calibration Tool By Any Measure



Length: 5.7in.; 145 mm
Weight: (without batteries) 2.3 oz.; 65g

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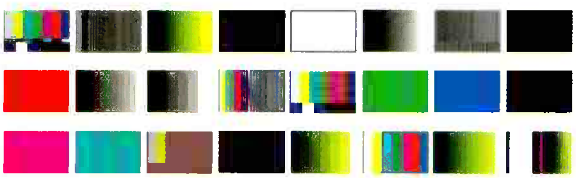

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picture height of 18 inches requires the viewer to be seated at a distance of six times the picture height or nine feet. A 16:9 1,125 line, 1,080 active line, HDTV picture displayed on an 18-inch picture height CRT requires the viewer to be seated at a distance of three times the picture height or 4.5 feet. This requires a change in the viewing habits of the average home viewer. Maintaining a nine-foot viewing distance results in a loss of picture detail perception or the need to purchase a receiver with a 36-inch picture height. Contemporary 16:9 direct-view CRTs with a 36-inch picture height are heavy, bulky, expensive and difficult to manufacture. The alternate technology of rear-projection displays lacks adequate brightness and has a relatively narrow satisfactory viewing angle. The developmental plasma displays are a few years away from consumer availability and will be extremely expensive until the original development investment has been amortized and large-quantity production has occurred.

The appreciation by the viewer of the increased resolution offered by the HDTV formats hinges on the availability of affordable large-screen receivers. Initially, there will be a limited availability of high-priced home display products, aimed at affluent viewers, which will do justice to HDTV pictures. Industry-wide coordinated product development efforts and long-term investment return strategies of equipment manufacturers will be required to offer attractively priced products. In three to four years, competitively priced large-screen home DTV receivers will make their entry into the market, providing broadcasters with the necessary incentive to invest in the purchase of HDTV production equipment. In the meanwhile, there will coexist a variety of analog and digital production formats that will require a great variety of format, scanning rate and picture aspect ratio converters to satisfy the specific needs of the broadcaster.

By Joe Zaller

Joe Zaller is the group marketing director for Snell & Wilcox, England.

Unfortunately, there is not a straightforward answer to this question. There are a number of DTV transition scenarios that a broadcaster may choose between. In doing so, broadcasters must balance the key issues from the commercial, financial and technical points of view. This evaluation must take into account not only the quality of service the broadcaster wants to provide to their viewers and competitive pressures from other stations in the same market, but also additional factors, such as fulfilling government requirements and the life cycle of existing capital equipment investments. Having done this, broadcasters can then examine the technical tools available to enable their chosen transition path.

Regardless of how the individual broadcaster chooses to transition to DTV, the common theme running through their deliberations will probably be how to leverage off the existing infrastructure investment. HDTV up- and down-conversion plays a key role in all DTV transition scenarios and will continue to do so long after fully digital DTV stations are on the air. Therefore, it is important to view HDTV upconversion, not as a short-term fix, but as an important long-term, high-quality investment that will be used throughout the DTV transition and beyond.

An upconverter is a tool that can serve to extend the useful life of a broadcaster's existing infrastructure. It will also play a critical role in archive retrieval once the transition to DTV has been completed. A high-quality upconverter will produce excellent quality DTV pictures — particularly if care has been taken in decoding and pre-processing incoming composite source material — or if this source material is high-quality component digital.

In the most basic scenario, stations could simply purchase an upconverter, a DTV transmitter and DTV encoder and be on the air with DTV. This is the least-expensive available option and probably fulfills government requirements. If a station has a composite analog infrastructure, then care must be taken to ensure that high-quality pre-processing and precision decoding are used in conjunction with upconversion to provide the highest quality signals.

Other stations will want to begin building "HDTV islands." These broadcasters will need upconverters to get archive and ENG signals into this environment. They should also be aware that the combination of HDTV cameras and high-quality *downconverters* will produce better quality standard-definition pictures than any other method. This is because HDTV cameras, when used as a front end, are highly oversampled relative to NTSC. The great advantage here is that users can begin to build a library of HDTV material for the future while delivering better quality standard definition today.

The most elaborate transition scenario involves building a fully digital HDTV facility. It's important to note here that high-quality upconversion and downconversion will continue to play an important role in this scenario — arguably a more important role than in the more basic scenarios. When upconverted signals are mixed with HDTV-originated signals, the quality of the upconversion becomes critical, because the two signals must mix seamlessly. Downconversion will also become important since broadcasters will still be required to simulcast standard-definition signals.

It's up to each station to determine how they transition to DTV and for how long they plan to rely solely on upconversion for HDTV transmission. However, the important message here is not only that HDTV upconverters and downconverters are going to be key elements of broadcasters' DTV transition plans no matter what they decide to do, but also that HDTV upconverters and downconverters will continue to play a key role for the foreseeable future. Therefore, investing in the highest quality products possible is essential.

By Phil Hejtmanek

Phil Hejtmanek is director of technical operations for WWJ-TV, Detroit.

There are many factors that may affect the decision to expand a station's DTV facility beyond the simple upconverter solution, not the least of which is the size of the station's market and the

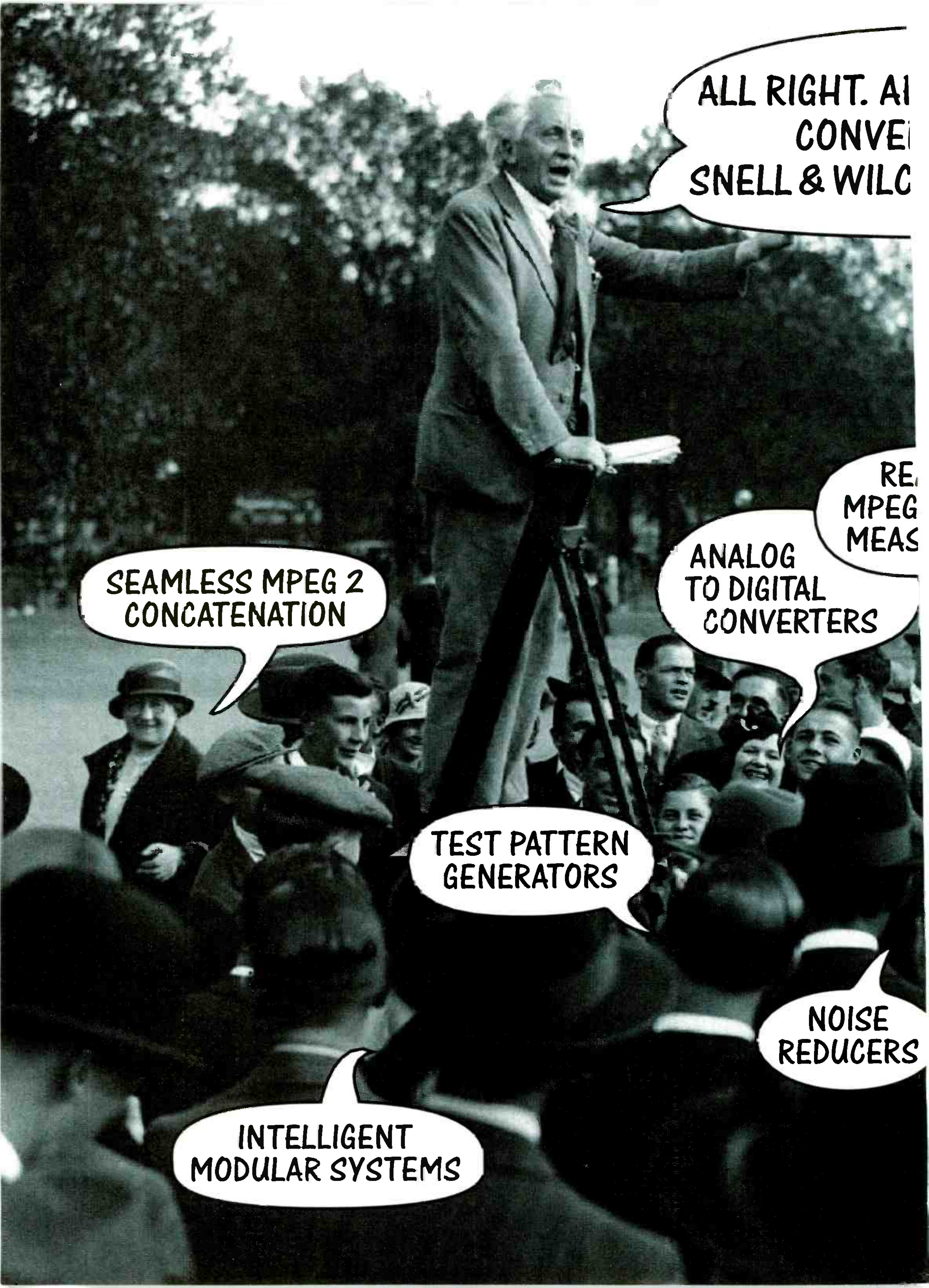
DTV receiver penetration in that market. Small-market, independent stations will probably be the last facilities to make a serious monetary commitment to DTV hardware, because there just won't be a significant number of DTV receivers in those markets to justify it until the latter part of the NTSC-to-DTV conversion cycle. Those stations will simply convert their existing NTSC product, until the termination of NTSC service forces them to either go fully digital or disappear.

On the other hand, the large-market network affiliates and O&O stations will likely be the first to build DTV facilities. In these markets, DTV receivers will first become available and government mandate will require the early construction of transmission facilities. These larger stations are more likely to have the capital budgets and financial backing to make the expensive studio transition. In fact, many large-market stations already have significant digital infrastructure in place and will only have to make relatively minor additions to their facilities to accommodate 16:9 aspect ratio and HDTV screen resolutions.

Affiliate stations that receive HDTV-resolution program material from the network or program syndicators will have more immediate requirements for some form of digital infrastructure, because there is likely to be the requirement for insertion of local advertising or at least local branding and station identification, produced in HDTV. Simply upconverting the local material and cutting it into native HDTV programming will work for a while, but pressures from competitors and advertisers will demand local material in full resolution. This will generate a requirement for at least the capability to store and play back digital material, as well as mixing and keying. There are several schemes out there today for cutting between compressed MPEG bitstreams, while hardware already exists for manipulation of uncompressed digital video.

All of these suppositions assume, of course, that the networks and program providers will have significant DTV offerings for their affiliates, early on. It is likely that some of the major networks may not be ready to provide a full broadcast day of DTV material when the first digital stations debut with actual programming this year. In that event, simply upconverting the existing NTSC service for most of the day will serve to satisfy FCC operational requirements, but will do little to demonstrate the advanced capabilities of the ATSC digital system.

Many critics have argued that the business model for DTV has not yet been well-defined, meaning that the business justification for making capital improvements in the form of a digital studio facility may not be apparent at this time. This is especially true if the existing NTSC infrastructure is a long way from full depreciation. However, no station should contemplate major facility changes or improvements from now on, without making these changes using digital equipment. There is no disputing the fact that digital television is the way of the future.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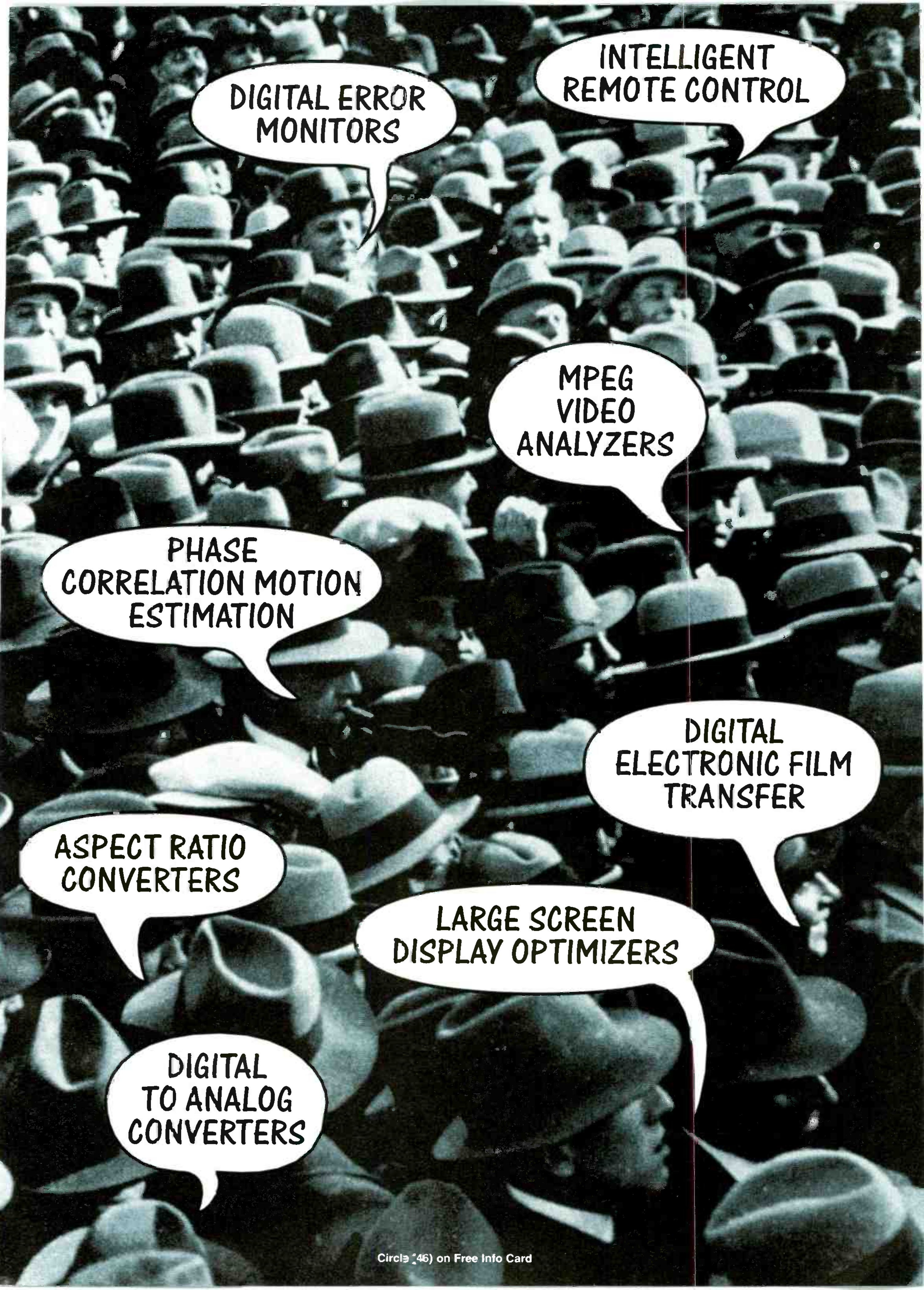
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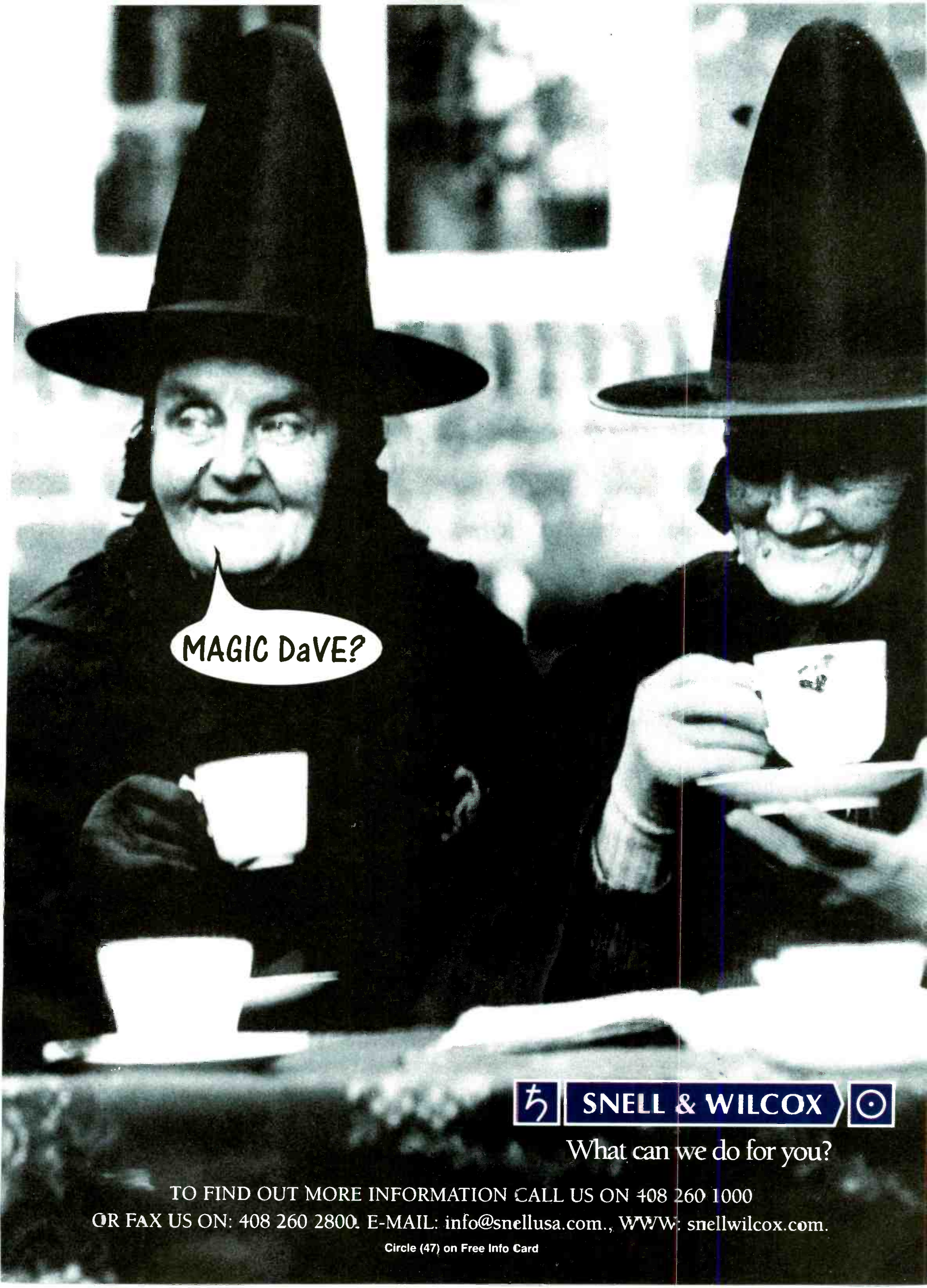
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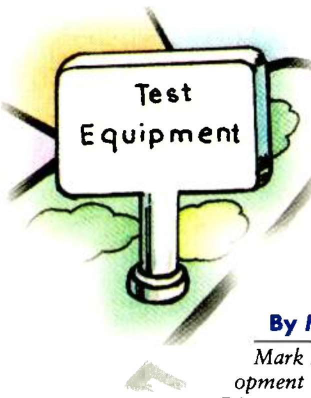

Question:

What new types of test equipment should stations plan for when building DTV facilities and what budget will that require?

By Mark Everett

Mark Everett is vice president, product development at Videotek Incorporated, Pottstown, PA.

I see the question of test and measurement costs as something that will not change significantly over time. That is to say, an average waveform and vector combination scope will cost about as much in any given DTV format as a similar device costs today. There will be some differences — pioneers pay more, and often, the first generation of anything lacks desired features. I think the question has some unique facets, each of which should be addressed separately.

Production at a given broadcast facility will, most likely, eventually be in one format. It depends on the facility to determine which one. Once that format is selected, then new versions of DTV waveform and vector displays will take on many obvious and subtle changes. Traditional tube devices are being replaced with five-inch VGA displays. Much larger SVGA and XVGA displays are rapidly moving into the whole testing arena and are serving multiple functions. As long as we have cameras and graphics-generating devices, we will need scopes to view levels and shading and all of those things that man and physics can set asunder.

Production houses have a larger problem, their clients can demand any number of formats and certainly, commercials might be produced in many formats for different markets and rate cards. The more flexible and adaptable their equipment is, the better off they are. Their scopes would best be multiformat, just like DTV sets. This equipment is not yet invented, and will probably meet the price demands through clever engineering,

We can certainly meter six channels (or is that 5.1) of audio, but listening to that in a tape room or busy master control area might prove to be a bit of a speaker location problem. We have to develop some more creative solutions and I'm sure we will.

In the transitional period, all bets are off. Stations that intend on passing the network feed through without local intervention will need only transmitter and satellite (or however the network arrives) receiver test instruments. These devices are just being invented and early versions will cost a lot. MPEG testing is available, bitstream analysis equipment ranges from well-established to not yet invented, depending upon what a given site might want to test.

I think our analog roots will never completely leave our control rooms. As long as we collect analog light through camera lenses and project analog light to our eyes and analog sound to our ears, we will be making analog judgments and requiring analog analysis and analog corrections to our (whatever format) signals.

By Kenneth Hunold

Kenneth Hunold is an audio/video project engineer for the ABC Engineering Laboratory, New York.

Digital television is going to require new solutions and new equipment. The requirements for test and measurement will likewise be different. Specifically, new and different tools will be required for monitoring the ATSC transmissions that we will be creating.

If current trends continue, many stations will be purchasing their own ATSC encoders. Those who do will be responsible for monitoring the ATSC datastreams that these encoders will produce. As a by-product of the flexibility of the ATSC system, there is a dizzying array of "elements" that will make up the ATSC bitstream. Creating bitstreams is not something that many broadcasters have experience with. At its heart, an ATSC bitstream is an MPEG bitstream. There are many MPEG analyzers, as well as "bitstream players" being developed for broadcasters. These analyzers will be used to check ATSC bitstreams. Also, a known ATSC source is required to check the next item in the transmission chain, the 8VSB modulator, as well as the transmitter itself. These bitstream players may be the DTV equivalent of a color bar or composite signal generator.

Monitoring the output of the transmitter will take on a new meaning in the DTV era. There are no visual or aural carriers in 8VSB. The carrier itself is suppressed, replaced by a pilot signal that stands out above the seemingly random, noise-like 8VSB signal to aid the receiver in acquiring your signal. So, what's left to measure? Plenty! For NTSC analog operation, errors such as differential phase and gain might lead to poor color fidelity. In 8VSB, similar distortions create things like adjacent-channel interference and "modulation errors." Lack of modulation accuracy doesn't just give you a bad picture, it can cause whole sections of your audience to lose your station completely. Never before has there been such a clear connection between signal quality and potential viewing households (and ratings). Welcome to life in the digital age!

Don't let the thought "Don't worry, it's digital" creep into your planning for digital television. What you don't know can hurt you! DTV "modulation analyzers" will be important for monitoring your station's DTV emissions. When you go to NAB, talk to the transmitter manufacturers — lots of them. Find out what they recommend for monitoring. Check what they include as part of the transmitter package and what parts you will need to provide. Talk to the test and measurement manufacturers to see what is available and what each offers for ATSC and 8VSB monitoring. Learn as


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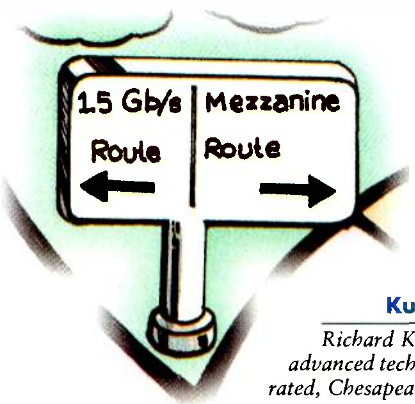
much as you can about MPEG, ATSC and 8VSB and check with your group engineers and/or consulting engineer for their opinions. Often, there may be a consensus in your group (or even market) about operator interface or even transmitter interface. We all have much to learn. Don't be afraid to ask. It's not something you can't handle. It's just something you have to be aware of and plan for.



Question:

What key factors should be considered when planning an infrastructure for a DTV facility?

By Richard Kupnicki

Richard Kupnicki is vice president of advanced technology for Leitch, Incorporated, Chesapeake, VA.

As we venture toward DTV, the best approach to understanding the future may be to review the past. Each major change results from some enabling technology allowing us to build and extend current topology. In the mid-70s, high-speed analog/digital converters allowed digital video processing for the first time. We had to learn about issues like quantization noise and the importance of audio-video delay (lip sync) due to cascading of video synchronizers. In early 1990, we began converting to a totally digital distribution. We had to decide between component and composite facilities — a choice much less obvious eight years ago than today.

Today, we are again at the crossroads, challenged to choose among 18 DTV formats. Whatever the format choice, MPEG-2 compression technology enables digitized video to be transmitted through channels previously suited only to analog or telco transmission. But, MPEG compression requires inputs of digital component video and, therefore, requires that composite facilities be converted.

The output from MPEG compression is data and is the point where any resemblance to video ends. This data resembles the files on computer discs or office LANs more than the 270Mb/s video data moving around facilities today. Whereas today's video facility distributes synchronization (clock, horizontal and vertical), only clock recovery is explicitly defined in the compressed domain. Horizontal and vertical timing is loosely defined and varies with initial conditions of buffers, compression mode and data rate. Long delays through video or audio compressors require time-stamping for lip sync. Distributing accurate time-code as part of the color black reference could help solve the lip sync and H/V timing by referencing everything to the absolute time of day.

The issue of switching compressed video remains unresolved. It works for small GOP structures, but is difficult for large ones, especially those going to air. Hence, the dilemma — the smaller the data rate (higher compression ratio), the larger the required GOP and contribution-quality video degrades rapidly if transcoded.

So, what is the solution? To maintain high quality from camera to transmitter, we need a layered approach:

- Start with an island at 1.5Gb/s (for example).
- Lightly compress and record at 270/360Mb/s.
- Use the 270Mb/s infrastructure to deliver compressed and uncompressed video.
- Recompress to 50Mb/s 4:2:2 (chroma on all lines) for delivery to affiliates over satellite or to 34-45Mb/s 4:2:2 for delivery over telco channels (DS3, E3).
- Uncompress at the affiliate to 1.5Gb/s and integrate with local content.
- Compress to 19.3Mb/s and multiplex with compressed NTSC video.
- Deliver both datastreams to the transmitter over a DS3-rate STL.

We must take a futuristic look at the overall infrastructure and extrapolate from the past. In the '60s, the infrastructure was entirely analog. In the '80s, we carried analog video, but converted to digital inside the boxes. In the '90s, we started to carry digital video in the coaxes, and if we're wise, in the next millennium, we will borrow the infrastructure for carrying compressed video from the computer and telephony industries. After all, today's video is more like data than traditional video.

By Greg Johnson

Greg Johnson is director of engineering for KITV, Honolulu.

Many decisions will have to be made before building a digital TV infrastructure. One of the key factors will be deciding how to handle the various video resolutions available. Cost will be a factor, as will the conversion timetable. Equipment that will easily solve problems a year or two from now is not available today. For those planning to broadcast DTV as soon as possible, here are several key considerations relative to today's technology.

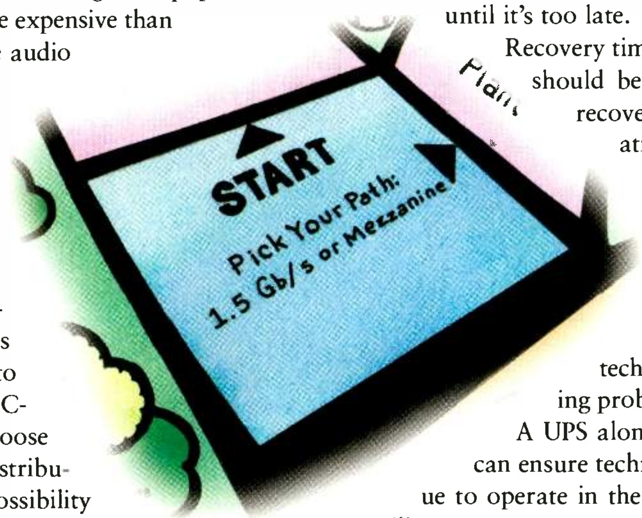
DTV signal format

To simplify the difficult task of selecting an in-house DTV format, separate the transmission standard from the production standard. Station infrastructure must support the various resolutions that must be processed. These may come from internal and/or external sources. For now, stations may choose to originate news and other local programming in 525i widescreen, because many broadcast and professional cameras and monitors are equipped to handle 4:3 and 16:9 aspect ratios. In this case, the serial data rate for 16:9 component video is 270Mb/s (in some cases 360Mb/s) allowing the use of existing component digital equipment. Additionally, the widescreen 525i signal can be easily converted to the 480i or 480p line, 720 pixel/line standard-definition DTV transmission format. This standard-definition video could also be upconverted to higher-resolution

data rates (HDTV) for subsequent broadcast. Limited production may be done in higher HDTV resolutions, while in larger markets, entire facilities may be converted to HDTV. However, current equipment choices are limited.

Routing and distribution is one of the more difficult areas to be considered. At present, most digital video switching and distribution equipment supports up to 360Mb/s. Uncompressed digital HDTV needs upward of 1.2Gb/s, but so-called "mezzanine" compression allows compressed HDTV to be distributed on 270Mb/s equipment. Look carefully at possible upgrade paths to higher data rates when choosing routing switchers. In some facilities, existing analog switching equipment may be used in concert with a new digital video router. However, a good control system and path finding may be needed for efficient operation. Other options for HDTV include analog component distribution. At present, there are numerous unknowns, examine all the options carefully.

On the audio side, the cost of AES digital equipment continues to drop, but it is still more expensive than a clean analog audio system. If the audio portion of the facility is small, AES audio may be affordable and make sense in the long run. In larger facilities, attention to synchronization of large numbers of AES sources can become unwieldy, and may prove expensive.



Surround sound needs to be considered. The DTV standard, as adopted by the FCC, allows for up to 5.1 channels of program sound (AC-3). It is likely that networks may choose some level of AC-3 encoding for distribution to affiliates. Opening up the possibility that this audio may have to be processed and mixed with other sources. Two channel (stereo) audio may be sufficient in smaller markets, but thought must be given to pass-through and voice-over of network audio containing more than two channels.

Compression and storage

Pinpointing compression solutions is difficult. HDTV compression equipment is expensive and few choices exist. Standard-definition video can be compressed with commonly available Digital Video Broadcast (DVB) equipment modified to output compatible ATSC datastreams. These datastreams can then be multiplexed into an ATSC-compliant 19.4Mb/s datastream.

The storage media available for digital video is quite broad. Video servers may present the biggest challenge when considering higher resolutions. MPEG compression offers the best efficiency for servers and videotape, although edibility may be limited. Motion JPEG, while not as efficient as MPEG, allows easy editing. It is possible that video servers capable of handling uncompressed 270Mb/s signals, could be used to handle HDTV compressed at a mezzanine level.

Video monitoring

Thought must be given to the size of 16:9 monitors used in control rooms and throughout the facility. In some situations, it may not be possible to get a sufficiently large monitor that will fit in a 19-inch rack. For example, the cabinet for a 16:9 monitor with the same picture height as a 4:3 19-inch (diagonal) rack-mount broadcast monitor is over 30 inches wide. Correspondingly, the picture height of a 16:9 monitor that will fit in a 19-inch equipment rack is about nine inches. Control rooms may need custom cabinets or shelving for monitor walls.

Power

It is no secret that computer equipment must have continuous clean power. This is especially true when considering digital video equipment. In the analog world, power-related problems were easy to spot, as even small problems were evident in the video. With digital video, problems caused by power mains, ground faults or other noise on the ground system may be masked by digital video equipment until it's too late.

Recovery time from power interruptions should be considered. Analog VTRs recovered from power failures relatively quickly. Video servers, on the other hand, can take several tens of minutes to come back to life.

A station-wide uninteruptible power supply (UPS) can help isolate technical equipment from incoming problems from the power utility. A UPS along with a standby generator can ensure technical equipment will continue to operate in the absence of the commercial utility.

Balanced power distribution systems (similar to those commonly used in recording studios) can go a long way to minimizing ground loops and noise on the ground system. Besides lowering the noise floor for analog audio, a balanced power system helps prevent high-frequency noise and harmonics caused by switching power supplies from getting into the ground system and back into the digital video signal path.

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Do not forget that the signal must get from the studio to the transmitter. Most stations use a microwave system to relay program video and audio to the transmitter. The 19.4Mb/s ATSC datastream is easily multiplexed along with other data into a 45Mb/s DS3/G703 compliant stream. This same datastream is easily accommodated by the digital microwave systems designed for DS3. Digital microwave systems using a 16QAM modulation scheme are bandwidth-compatible with FCC part 74 broadcast auxiliary microwave channels. In addition, this datastream can be handed off to the local phone company. At the transmitter, the multiplexer can extract the 19.4Mb/s ATSC stream and send it to the 8VSB modulator.

Transmitter and antenna

Linearity of the transmission system, including the line and


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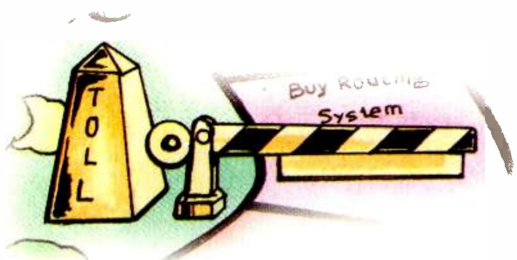
antenna cannot be overemphasized, as non-linear distortions will impact the service area. Unlike NTSC transmissions, where distortions do not necessarily cause a loss of signal, a distortion in the transmitted DTV signal can make it impossible to receive. Using a directional antenna to limit coverage to just the desired service area can reduce output power requirements (and the electric bill).

In summary, it is possible for broadcast stations to get on the air with a DTV signal sooner, rather than later. Although there may be many unanswered questions, with proper planning, stations can have a DTV signal on the air now and be in a position to implement additional DTV solutions as they become available.



Question:

When considering a routing switcher as part of a master control operation, what are the key factors to include?

By Steve Monsen

Steve Monsen is senior product manager, routing/control, for Philips Digital Video Systems Company, Simi Valley, CA.

When considering a routing switcher as part of a master control operation, the buyer should focus on three main areas: basic signal/control interface, machine control integration and system configuration. Simply put, the routing switcher should provide seamless integration and maximum communications with the master control switcher. Likewise, the master control switcher should be able to take advantage of routing switcher features and functionality, i.e., source selection using common mnemonic names, machine control access and common configuration software are critical to a smooth on-air operation.

The first and most critical consideration is system integration. How difficult will it be to connect the two switching systems together? How flexible is the operation? Will it be easy to access any or all sources on the router? Will the interface of the two devices be transparent to the operator?

The advantage of a routing switcher is its instant access to any source in the system. This feature is available in some master control products by connecting routing switcher outputs to the master control as assignable inputs. A status display associated with each source select button on the master control switcher will indicate the name of the source currently feeding that input. The more assignable inputs used, the more flexibility the user can enjoy. This is useful provided the user has plenty of routing switcher outputs and a means of controlling each one.

A more efficient approach, used by modern master control switchers, is to use two routing switcher outputs to feed the PST and PGM bus of the master control. The user can then assign any button to any source on the routing switcher, without using up valuable routing switcher outputs to do so. The signal names (mnemonics) should automatically track between the routing switcher and the master control to provide consistency between the two systems. With this "bus feed" system the user can reassign any button to any input at any time or arrange the sources in the order that best suits their own operational style. The advantages of the bus feed system increase dramatically as the industry moves into multichannel transmission and additional audio channels.

Additional flexibility can be gained if the routing control system offers *pathfinding*. Pathfinding will automatically route signals through multiple routers and format converters, enabling the master control operator to access any source, regardless of the signal format. As broadcasters progress in the DTV-transition from analog to digital, pathfinding will be a must-have feature in the master control suite.

The second most important consideration in any master control environment is integrated machine control, which plays a vital role in the operation. A well-designed routing control system should incorporate machine control capability and advanced routing systems should have the ability to associate video sources with automatic machine control assignments. This allows the master control operator to automatically access the machine control of any source selected on the master control switcher. If the machine control system also allows for delegation, multiple users will be able to share machines and, more importantly, specific machine control can be dynamically limited to the master control switcher, thereby eliminating any control conflicts.

Finally, an ideal integrated system allows for system configuration control from a single location using a single software application. Connecting to multiple ports within a system to change global system parameters is not only time-consuming, it also increases the risk of introducing errors into the system configuration.

A well-integrated routing switcher and master control system will simplify system wiring, allow for optimum resource sharing and provide maximum system flexibility for today's changing broadcast environment.

By Doug Buterbaugh

Doug Buterbaugh is product marketing manager for Tektronix Grass Valley Products, Beaverton, OR.

Master control is the lifeblood of a TV station because all main programming flows through its switcher. However, an important part of the efficiency and flexibility of master control comes from a product that is behind the scenes, the routing switcher.

In today's broadcast environment, master control must access a multitude of sources and signal formats. It is not

uncommon to need accessibility to 100 or more different sources during a typical broadcast day. A master control panel that would have direct access to all possible signals would be too large to operate. Therefore, a routing switcher becomes the important link that allows master control to address all the sources and inputs required.

For a smooth master control environment, the router must be able to handle new formatting technologies as they emerge. With DTV and HDTV right around the corner, the router should not only handle composite analog (NTSC) or component digital (270Mb/s), but also handle signals up to the full 1.5Gb/s bandwidth required for HDTV.

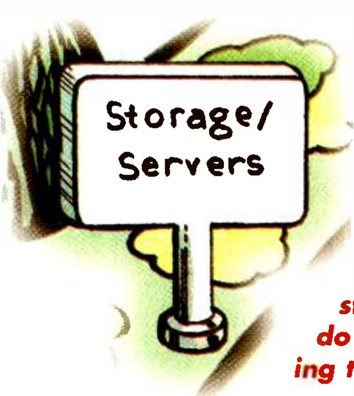
During this transition period from transmission of NTSC to DTV and HDTV, stations will be faced with multiple programming streams. These signal streams must be handled independently on different levels of a router. Each level must be capable of being controlled from either a separate master control switcher or from an automation system.

Downtime of the router is death to master control. If the router cannot make a switch, then the programming material being fed into the master control must be quickly patched around the failed router. Since any interruption of program material is a potential for loss of revenue, preventing downtime is critical in the selection of a router.

Redundancy of certain router parts offers a way to eliminate unwanted downtime by not having a single point of failure. A manufacturer must be able to provide not only redundant power supplies for the router matrix, but also for the control system. It is also important for the router to provide *true* redundant controllers, *not* simply two single controllers connected via a switch-over unit. With such a configuration, the single point of failure becomes the switchover unit.

When selecting a router, future size (inputs and outputs) requirements must be determined. Most of today's routers are field expandable. Typically, however, routers must be shut down during the expansion process. A pre-wired switcher (all frames, power supplies and internal wiring provided up front) solves this field expansion problem. Prewired routers are easily expandable by using plug-in cards that have no requirement to shut down the router.

Although there is an initial savings in purchasing a smaller router, the overall expansion cost is usually higher than the up-front cost of a larger pre-wired system. The total cost for field expansion includes the required router expansion hardware and the incurred labor cost and downtime to reconfigure or recable master control during expansion. It is better to make sure that ample expansion capabilities are taken into account at time of purchase.



Question:

What are the key factors to consider when buying a storage technology and how do they differ when considering tape vs. disk storage?

By Richard Pierceall

Richard Pierceall is marketing manager, storage systems for Sony Electronics, Inc.

When considering storage of video and audio materials, we are currently able to compare two distinctly different types of media: tape and disk. Both offer unique advantages and provide more benefits when combined in a way that best leverages the price/performance of each.

There are four elements to consider when making purchase decisions for storage: quality, interoperability, system features and cost.

Quality

As content is processed through the production chain, it is paramount to maintain the highest possible signal quality. Therefore, quality issues affecting storage start at the point of acquisition, whether it's in-house or in the field. Current professional digital acquisition systems use 4:2:2 sampling for maximum quality video, with four or more 16-bit to 20-bit uncompressed audio channels. This criteria should be carried through all of the storage media to minimize degradation during subsequent processing, layering and dubbing.

Equally important is the level of error correction and concealment built into the storage system. A system that carries a high level of error correction information with the data can deliver a higher quality signal, compensating for shortfalls inherent in all storage systems.

Interoperability

A strong consideration in choosing a storage technology is the interchange of media with other entities. In terms of tape, make sure that the format has a pervasive customer base capable of viewing or contributing to your material. For non-portable media, such as disk, it is important to consider the adherence to international standards for data exchange. In fact, it is a good idea to make sure any investment in storage takes into account the global acceptance of the technology. This will help extend the future compatibility with other equipment used during the production process.

System features

As stated earlier, the greatest benefit from a storage purchase can be gained when combining disk and tape technologies. Therefore, a storage purchase should consider the completeness of products using disk and tape.

Tape storage is still the best medium for acquisition and archiving. Since archiving requires a robust, cost-effective storage format, stability of the media and maximum tape lengths are important. For tape-based operations, format-native camcorders should be strongly considered. In addition, a new generation of small, lightweight portable editing systems is available, allowing a more practical way to bring the production process to the field.

Disk-based storage is ideally suited for non-linear editing and playback applications for short-form and repetitive material. The storage format should support a variety of editing

applications, from cuts-only ENG-style editing systems to more sophisticated post-production editing. The cost-per-minute of disk storage is still high compared to tape, so make sure that disk storage is modular and scaleable — enabling you to start small and grow with your requirements.

Cost of ownership

Regardless of the storage system selected, two ongoing cost factors will carry long-term implications: maintenance and media.

For certain applications, disk storage can offer a lower cost of ownership than tape. Disk storage generally carries a higher initial price tag, but this is offset by fewer mechanical components requiring less maintenance over the life of the product. Cost-per-minute of disk storage is also included in the capital expense of the product.

For those operations where tape is best suited, consider the product warranty, particularly for head assemblies, and the ease in which these parts can be replaced. Finally, be aware that any tape storage decision will require a large investment in recording tape; choose a format that offers long-term, stable operation with long tape life for multiple passes and low cost-per-minute figures for long-term archiving.

By Phil Livingston

Phil Livingston is assistant general manager, technology and systems development, for Panasonic BDSC, Secaucus, NJ.

The key issue for storage is that tape is not dead, as many pundits said a year or two ago. It is now clear that the two primary magnetic storage mechanisms (tape and disk) will coexist for some time to come. A disk-based server — no matter how large the disk array — will become full sooner or later and, almost regardless of the application, the user wants to save the contents for the future. In news, this is especially true, because the material arrives in an endless flow from networks, news sources, field crews and even viewers. This bounty of intermingled dross and gold is refined through editing, but still the sheer volume exceeds the capacity of a realistic server after a week or two. The real value is having and being able to find the archival footage a year or two later — when the subject is suddenly in the news again. Clearly, cost-effective long-term archival storage is tape-based and is linked to a material or media database.

Panasonic has built on the experience of Smart Cart and M.A.R.C. cassette library systems to create large (5,000 cassette) automated, robotic, on-line systems that allow disk-based servers, in conjunction with the material database, to archive and retrieve information in a way that is transparent to the user. This total system concept is possible because the server "knows" it doesn't have the material, but the database "knows" where to find the archival copy and how to transfer it from archive to server faster than real time.

The key to this system is lossless transfer between server and archive. In part, this transfer is also the key to keeping first-generation quality from intake to editing to server to archive and when needed, archive back to server. Panasonic has developed two ways to accomplish this lossless transfer: SDTI and FTP. SDTI is the use of the SMPTE 259 SDI physical layer, which now carries video and embedded audio, to carry audio and compressed video data in the active video space. This allows re-use of the existing infrastructure (coax, routers, patchbays, etc.) without the generational loss of decompressing and re-compressing. Note that some loss occurs even when exactly the same compression engine is used.

File transfer protocol (FTP) uses computer-type networking to carry the audio and video data as a file. You may ask why is there such interest in this technique. The designers of network protocols realize that we humans cannot tell if a file has been transferred completely and perfectly, so the protocol monitors the transfer and does all the housekeeping that an operator would do. Because this is digital data, the file either arrives perfectly or it doesn't, and if it doesn't, the system can alert a person to intervene; when properly designed, the need for human interaction is a rarity. Note also that in modern file systems, unlike the ones we use with Word and Power Point, a file can be opened before the transfer is complete. This allows creation of a file-based system that operates much as we do today with audio and video signals.

Lastly, I'd be remiss if I didn't say we see tape used for acquisition for some time to come as well. While we, like many other manufacturers, are trying to develop a disk-based camcorder, we know the data rates, running times and demands of professional users all converge to make videotape the most practical media for field acquisition. The wide acceptance and adoption of DVCPRO, DVCPRO 50 and DVCPRO 50 progressive seem to be testimony to this fact.

By John Ajamie

John Ajamie is director, network operations, duplication services and quality control for Home & Garden Television and Cinetel Studios, Knoxville, TN.

Questions we asked ourselves over three years ago still hold true today when considering tape vs. disk storage.

One of the first things to determine is how the storage technology will be used in your facility. For our facility, on-air was the key factor. For many applications, including ours, the primary benefit of disk storage-to-air is random access for last-minute changes — something which is more difficult with tape. Additionally, we knew that the wear and tear on VTRs, tape and robotics of cart machines would be reduced and mechanical errors to air would be eliminated. Operator intervention and the resulting on-air errors have also been reduced by disk storage-to-air. Another benefit was a reduction in the overall amount of maintenance required.

How reliable is disk storage vs. a tape system? With either system, some level of redundancy is required in most facilities and should be considered. An option is using disk storage as a primary device with tape as a back up. If tape is not an option, two independent disk storage systems can run

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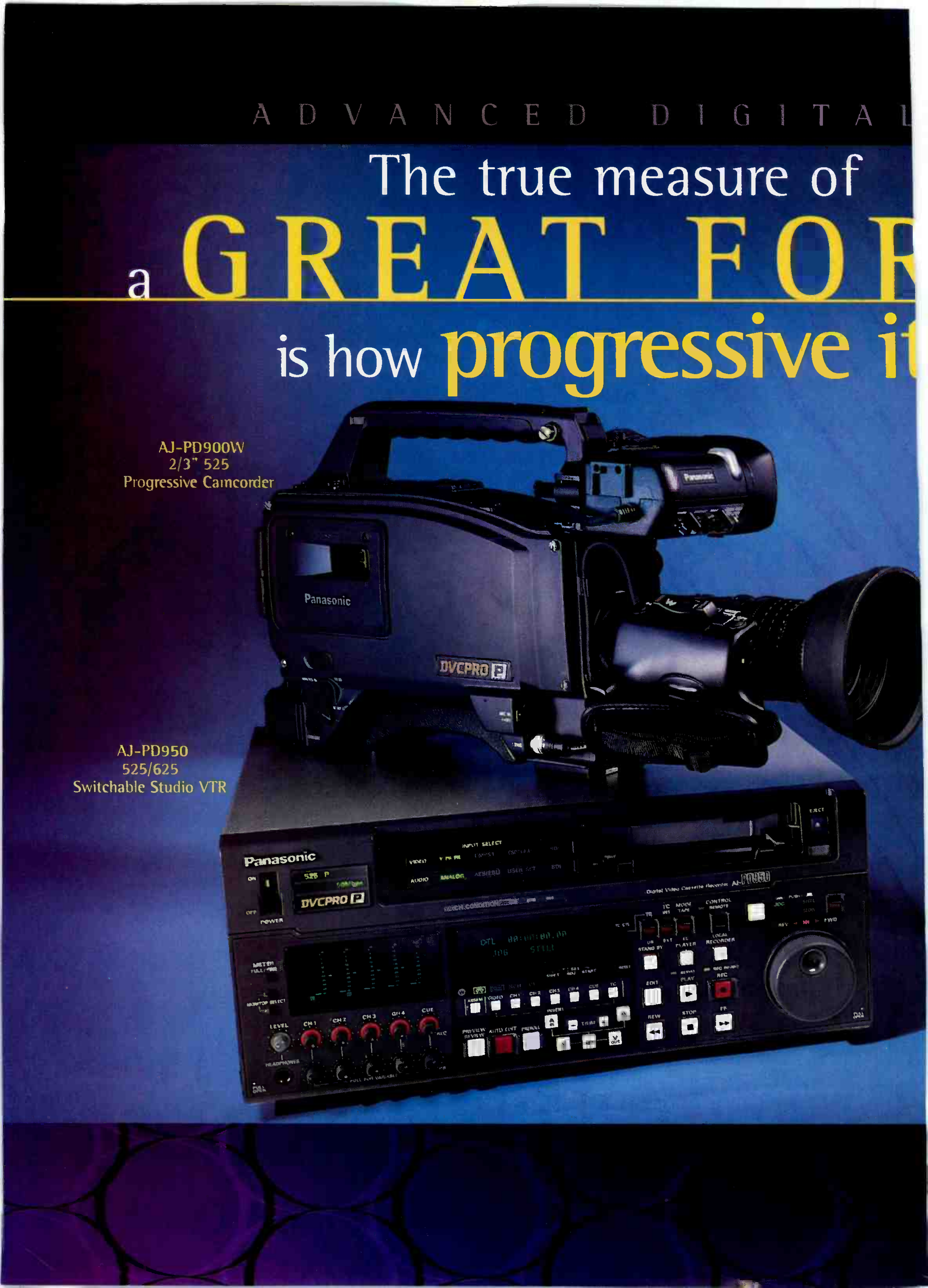

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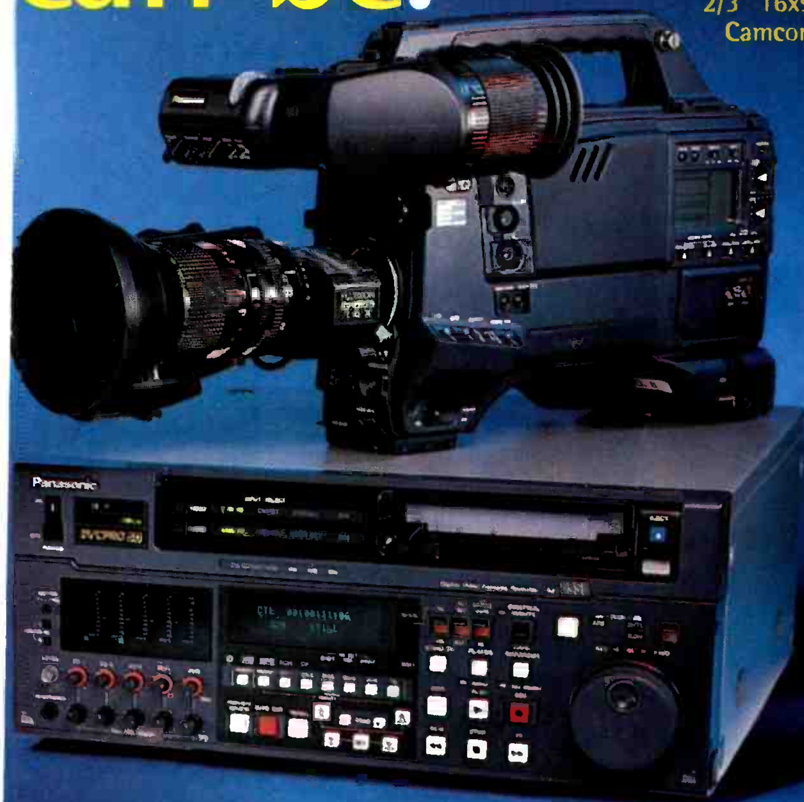

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in parallel. As far as the costs are concerned, just remember, in either case, you get what you pay for.

Relative to the total amount of storage time, a decision concerning what will be stored is needed. The way to determine this is to work closely with your traffic department to calculate redundant spots and shows. This will give you an accurate time of how many hours of storage you'll need.

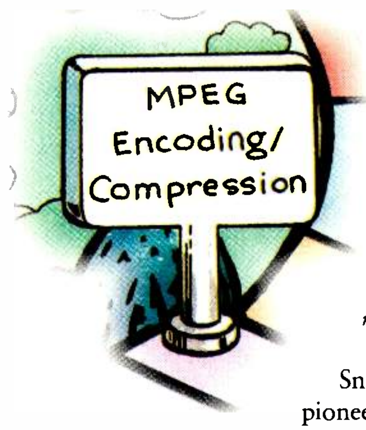
Flexibility is another key issue and not all disk storage systems offer the same flexibility you have with tape. Some require additional automation controllers. Dubbing material into a storage device is time consuming. Figure out how much time is available to dub material before it needs to air. Extra staff or an automated cache system may be needed. Additionally, a system administrator may be required to manage multiple databases.

Other questions we asked ourselves included: Was multichannel operation required and were there any future applications beyond the network's environment that this technology could support? Within a multichannel environment the information can be shared within the disk storage and this can reduce the staffing requirements that would be associated with additional tape-based equipment. If the system is shared with other departments, most networked disk storage systems can be easily expanded, whereas tape storage could potentially require additional VTRs and possibly additional tape costs due to multiple copies.

If the selected system uses compression, how much is acceptable? What compression schemes, such as JPEG or MPEG, are required for your operation, and which are supported by the storage technologies under consideration? Our interstitial material resides in a variable-compression JPEG disk storage. We monitor a DBS system that processes our signal through MPEG compression. In technical terms, our signal looks as good coming back as when it left. There may be some concatenation effects to your signal being passed through multiple facilities and multiple compression schemes before it reaches the consumer, so consider the following: fast-moving video and saturated chroma will affect the way your video is compressed. Before deciding on a system, test some typical footage and store it within the disk storage system using various compression levels. Once an acceptable level of compression is determined, you can determine how much storage is needed for your operation and how cost-effective that storage will be.

Other issues involved are whether your material has been produced 100% within your facility. If you are accepting various tape formats from outside facilities and passing it through your storage device, the material could be degraded due to possible concatenation effects. The type of source material and whether an outside facility is composite analog or component digital may also affect the ultimate quality coming off your server. The same holds true about where your finished product ends up. Are you moving toward a tapeless environment with non-linear editing systems and passing those files to an on-air disk storage with different compression schemes within your own facility? There may be some quality, as well as protocol assurance, that needs to be done.

Go to a facility using the storage technology you are interested in and see it work. Talk to the operators and engineers. Listen to what they have to say, but take it with a grain of salt. Remember, your operation is different than anyone else's, so trust yourself and make sure the system works for you.



Question: What new MPEG encoding technology should buyers look for on the '98 NAB exhibit floor?

By David Brooks

David Brooks is with engineering coordination & planning, Snell & Wilcox, England.

Snell & Wilcox has played a pioneering role in video compression by providing innovative products for compression pre-processing and real-time compliance testing in the MPEG chain.

One of the biggest concerns in the compression world is the effect of cascading compression systems on the quality of the broadcast. The MOLE revolutionary information bus format enables the seamless cascading of MPEG-2 encoders. A technology demonstration on the Snell & Wilcox stand will show no cascade degradation, even after decode/presentation suite/recode processing such as may occur in a local or regional studio. Such cascading occurs throughout the broadcast chain to facilitate processes, such as editing, advanced post-production and the insertion of captions and logos into MPEG-2 streams.

MOLE is a result of the work that Snell & Wilcox has done with the ACTS ATLANTIC project. It gets its name from the small furry creature that burrows through the earth. When critical MPEG-2 encoding information is embedded in the special MOLE format, it can "burrow" within the video through conventional digital studio equipment and emerge at the other end to accurately reconstruct the MPEG stream without concatenation errors.

Pre-processing

Seamless cascading will not help if the original compression was inadequate. Compression engines are vulnerable to signal defects, such as noise, film grain, dropouts, residual subcarrier and time-base errors, pre-processing is essential to maintaining optimal video quality in DTV broadcast systems. You only get one chance to make a first compression and high-quality preprocessing is essential to keep quality high during this first step. The Snell & Wilcox

CPP100 Prefix Compression pre-processor enables optimization of video before compression. Incorporating six filters to remove unwanted signal elements and optimize performance at low bit rates makes any MPEG encoder look better. Prefix is in daily use by some of the world's major satellite broadcasters who use it on hundreds of channels.

MPEG test and measurement

Keeping quality high is a good aim, but how do you tell where the quality has gone and why? Real-time DTV test and measurement for ATSC and DVB systems are a MUST for NAB '98. New requirements for the measurement of DTV streams to ensure compliance with standards requires video, audio and data analysis. The MVA100 video analyzer can display MPEG encoding quality at the picture, slice and macro block levels. This is complemented by transport stream analysis that provides a complete program "health check" to ensure, in real-time, that the transport stream with all its service information tables and timing information falls within the specifications. Reference bitstream playing completes the picture, with testing streams for ATSC HD & SD pictures, with and without the service information data to bind services together. A veritable test pattern generator for the new millennium.

By James Durant

James Durant is a product application manager for Barco Communication Systems, North America.

Since last year's NAB, a good number of MPEG encoding products have begun to surface. In particular, products that will allow broadcasters to transmit DTV in either multichannel SDTV or single-channel HDTV with each having their own benefits.

Buyers looking for multichannel SDTV encoding systems should find many to choose from. The majority use a discrete approach where each program is individually encoded in its own subsystem and then multiplexed with other programs in a separate transport stream multiplexer unit. This transport stream is then formed into a terrestrial DS-3 or an ASI interface. Another approach is an MPEG encoding system, that is available as a fully integrated package where all of the programs are encoded, multiplexed and formatted as a DS-3 or an ASI within the same chassis. The discrete versions allow for a simpler approach for redundancy, while the integrated products offer a more compact and cost-effective solution.

An MPEG encoding system, to offer buyers solutions, must address their fundamental needs. The new encoding systems will allow buyers increased flexibility in the encoding process. Broadcasters, for example, should be able to tailor a system to support their specific requirements, such as individual program bit rate, GOP structure, video delay and ancillary data support, i.e., VBI support. Encoders should also offer some form of program management within the transport stream multiplexer. Broadcasters should be able to remove, extract and/or add programs within their aggregate transport stream using management software that interfaces to the MPEG encoding system. A wide variety of output interfaces should be available. A DS-3 interface would allow for transmission through an existing telco network. An ASI transport stream output will allow a digital connection to a satellite modem or digital microwave system. The ASI interfaces also give broadcasters the opportunity to use modulation schemes, such as 8PSK and 16QAM, to increase their available transport bit rate. This provides a mezzanine level for transmission above the limitations of a telco DS-3 (45Mb/s). In some applications, these higher-order modulation schemes can allow transmission of a mezzanine level at data rates between 60 and 100Mb/s.

Buyers looking for HDTV MPEG encoding systems will find few, if any, fully developed. Those that are available are likely to be cost-prohibitive for most applications. It may be more realistic to find an SDTV MPEG encoding system that offers a migration path to HDTV MPEG encoding, as the core technologies of many systems are duplicated and could be reused. Only the video and audio processing portions would need to be changed, lessening the economic burden for broadcasters looking to do SDTV multicasting until the HDTV technologies becomes more affordable.

Buyers should be able to find a variety of MPEG encoding technology available this year, the key is to match system features with your needs and budget.

By Matthew Goldman

Matthew Goldman is director of engineering, advanced technology, for DiviCom, Milpitas, CA.

At NAB '98, buyers of digital networking solutions should be looking for MPEG encoding products that meet the needs of their current and future environments. Features, such as 4:2:2 and 4:2:0, should be supported, as well as standards that support DTV and FCC mandates. Products in the area of data broadcasting offer new ways for TV service providers to expand revenue streams.

4:2:2 encoding provides professional quality for the contribution and distribution markets. This format enables a series of encoding/re-encoding known as "cascading," that in other formats may degrade quality.

4:2:0 is still the only standard format for emissions; look for advances in constant bit rate (CBR) and variable bit rate (VBR) encoding. Advantages of CBR include maintaining video quality with more programs sharing the same bandwidth channel or providing higher-quality video to the existing number of programs for bandwidth-intensive content, such as live-action sports. With VBR, the service provider can even further increase the number of digital programs in a transponder/broadcast channel.

Buyers should look for data broadcasting solutions due to the MPEG-2 DSM-CC standard (also adopted by DVB and in draft form by ATSC). TV service providers are looking for ways to increase their revenue. Now they can send ancillary data within the same transport stream as the compressed video and audio. Applications will probably include elec-

tronic program guides, links to web pages and software downloads. I'm envisioning products that will hook into an MPEG multiplexer. We might also see some exhibits that address MPEG over IP.

Buyers seeking standards should search for products aimed at the ATSC's digital TV standard, A/53; that has been mandated by the FCC. Multiple standard-definition digital programs are supported within what used to be a single 6MHz broadcast channel. You'll also see early implementations of high-definition encoder products.

Watch for exhibitors receiving "live" HD and SD feeds on the show floor. There will probably be demonstrations showing live MPEG encoding at various formats (1,080I, 720P, 480P and 480I). The signals could be sent to a local broadcast station for over-the-air broadcasts and subsequently received back in the show hall. In other words, the digital TV standard is real. HD is not the only exciting aspect of DTV; it's the ability to send multiple programs and data services, which are enticing for broadcasters looking for new revenue opportunities.

Look for some two-channel encoding and multichannel pass-through of audio. Integration of Dolby AC-3 audio should not be missed, since it's also part of the ATSC/FCC standard.

In summary, buyers should be looking for MPEG encoding technology products that increase the efficiency of their transmission bandwidth and provide ways for them to expand their revenue streams by offering more channels of programming over the same amount of bandwidth.

By Steven Blumenfeld

Steven Blumenfeld is director, strategic alliances for GTE, Carlsbad, CA.

Why is it that NAB looks more like CES every year and vice versa? The reasons are simple — smaller size, lower cost, better quality, ease of use and a constant barrage of new features.

It was not that long ago when my first real-time MPEG-1 encoder cost more than $200,000, required two operators and a lot of fancy programming. Now, I can buy the same quality device, hook it up to my PC and start encoding right at home. When I am done, I can burn a CD and watch it on my television — all for less than $900. Amazing, isn't it?

This year's NAB should be a treasure trove of high-end MPEG-2/DVD systems. Expect to find a number of self-contained compression workstations. These units incorporate the encoder, computer, drives and decoder all in one rack-mountable unit. These systems are designed to save space, time and money. The major advantage of these systems is that compression, authoring and final mastering can all be done in one place by one person. Although this is a benefit to some,

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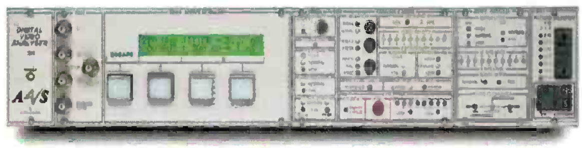

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especially smaller encoding facilities, it can be a major disadvantage to others. This architecture makes the process of authoring and encoding serial in nature.

On the other side, there will be a number of vendors showing a distributed network approach to encoding and authoring. The advantage of this architecture is that multiple processes can occur in parallel, thereby allowing more control over the process. In a distributed model, more than one job can be worked on at a time by either the same operator or by different operators. The disadvantage is that the data must be stored centrally or moved from process to process. So, be on the lookout for vendors showing off high-speed network technology as part of their core system components.

Keep a close eye out for "network-aware encoders." These real-time dynamic variable rate encoders will start to show up in the near future. the telcos and cable companies are pushing higher-bandwidth connections close to the edges of the network. Now that xDSL and cable modems have begun to proliferate, it won't be long before encoders will be directly tied to the network through a battery of routers and switchers.

Anyone having used the first-generation authoring tools will be glad to know that this year's NAB will bring many new and useful interfaces to the authoring side of the technology. Be on the lookout for ties to traditional multimedia development tools, such as the previously announced Macromedia Director/Sonic Solutions alliance.

This year should bring in the first signs of the next-generation compression chips. New chipsets from C-cube, Sony and Philips should begin to appear at this year's NAB. These new chips will reduce the overall chip count and, therefore, we should also start seeing lower prices. Beware, these same chips — or their close relatives — will appear at next year's CES in DVD camcorders, home decks and a variety of other devices.

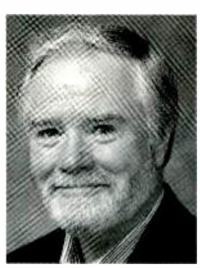
Question:

Progressive vs. interlace, what are the trade-offs between these two camera technologies?

By Laurence J. Thorpe

Laurence Thorpe is with Sony Electronics Inc.

The pivotal issue within the progressive-interlace discussion is bandwidth, and in particular, the ramifications of bandwidth limitation. This limitation touches every video equipment, video subsystem and transmission link within the larger TV infrastructure. But, none more so than the picture source itself — the TV camera.



The essence of camera trade-off — optimizing 3-D sampling

The camera's available bandwidth must be deployed among three simultaneous sampling "dimensions" of the video signal created within the TV camera — the horizontal and the vertical (which together constitute the spatial resolution capability), and the temporal sampling (which is a measure of the motion capture capability of the camera). Each of these sampling mechanisms contributes important elements to the total picture quality. Each also introduces its own artifacts.

For a given 3-D sampling structure, progressive scanning is unquestionably superior to interlace scanning. *How much better*, however, is where passionate debate can be joined. Within the search for objective assessments of overall picture quality *and* the many camera artifacts, interlace can sometimes take a quite unwarranted "bad rap" within the heat of this technical dialectic, while the merits of progressive are often elevated beyond their reality.

The ultimate trade-off — the issue of the camera vertical-temporal pre-filter

The infamous Kell Effect is invariably raised in most debates on the relative merits of progressive and interlace cameras — with a variety of numbers quoted for the same (depending upon the viewpoint of the protagonist).

There is *no* Kell Effect in a TV camera (this effect is *exclusively* a TV display scanning phenomenon). There is, instead, sophisticated pre-filtering that is central to achieving an optimization of vertical sharpness *and* a reduction of vertical aliasing (an old technical trade-off in a subsampled TV system like our present 525-line) for *both* camera systems.

Progressive scanning has a static vertical alias that is troublesome. Interlace scanning has that same alias plus a "flickering" alias (at 30Hz in our 60Hz systems). In the live camera, this latter alias is well-controlled — by virtue of a precision optical prefilter and the FIR cosine vertical filter cleverly incorporated in the CCD readout mechanism — and it rarely manifests itself on normal program material.

The progressive scan camera retains a modest advantage in vertical resolution, but nothing like the 2:1 advantage sometimes claimed by those who ignore the fact that the progressive scanned camera must also prefilter (if its static vertical alias is to be brought under the same degree of control as that of the interlace camera). The progressive scan camera does have a superior capability in implementation of a vertical detail enhancement system.

Thus, for a given 3-D sampling structure (for example, the 480-line 60Hz system for SDTV), the progressive camera will exhibit a superior vertical sharpness and lower aliasing. Objective assessments on test charts reveal these advantages. However, subjective evaluations of the two cameras, over a wide range of scene content, always reveal a smaller advantage than is sometimes anticipated. This visible, but still modest, improvement in picture quality must be weighed against the *doubling of bandwidth* (and digital data rate — some 540Mb/s vs. 270Mb/s) of the progressive camera over that of the interlaced camera with its consequent implica-

tions for the subsequent recorder and TV system.

The issue of motion capture by the TV camera

It is frequently claimed that a 60Hz progressively scanned camera has superior motion capture (especially significant in sports coverage) over its 60Hz interlaced counterpart. In fact, real-time motion reproduction is identical between the contemporary CCD operating in either 60 field or 60 frame. This is because the actual opto-electronic capture uses all CCD sensors every 1/60th of a second for both, and because interlace is subsequently synthesized — exclusively within the CCD readout system. This "downconversion" (and the associated FIR vertical filter) in the interlaced camera tightly couples the vertical-temporal domains. The resultant trade-off is a loss of vertical MTF in exchange for an enhanced temporal response. There can be, however, a motion artifact manifested in the form of a serration of sharp vertical transitions during rapid horizontal motion (sometimes called "interlace smear"), which is caused by a failure of the vertical filter at high frequencies. Again, from a subjective viewpoint, this is rarely a troubling artifact over a broad range of real-world scene content.

The crucial sensitivity and noise issue

The TV camera is, by its nature, a baseband video system. For a given 3-D sampling structure the doubling of bandwidth of the progressive camera translates to an elevation in front-end noise — which reduces camera operational sensitivity. The vertical filter used in interlace doubles the accumulated charge in the CCD every 1/60th of a second, thus endowing that camera with a further 6dB (or one f-stop) advantage in operational sensitivity. Picture source noise is a far more serious consideration today — in a DTV environment that is based heavily upon significant MPEG compression for video delivery to the consumer — and it, therefore, must constitute a key aspect in future examinations of trade-offs.

The most difficult debate — comparison of different sampling structures within the progressive-interlace exam

Where bandwidth is demanding and severely curtailed — as it surely is in HDTV by severe technological constraints in recording, processing, transmission etc., then the discussion devolves to the trade-off between picture capture rate and spatial sampling. The most notable example here is, of course, the 1,920x1,080 60Hz interlace camera and its 60Hz progressive counterpart, the 1,280x720 camera. The latter reduced spatial resolution to 44% of the former in order to meet the same general bandwidth and digital data rate (approximately 30MHz and 900Mb/s).

Now, the discussion of camera trade-offs generally becomes one of perceived spatial resolution vs. perceived artifacts. Unfortunately, such assessments sometimes fall victim to the biggest trade-off of them all — the CRT display.

A 30-inch picture is nowhere near representative of an HDTV viewing experience. Nor are CRTs of that size able to properly reproduce a 1,920x1,080 picture — their limiting resolution coincides with band-edge of the 1,920x1,080 system, producing a significant shortfall in display MTF. Most DTV pictures tend to converge in terms of image quality when portrayed on this "low-pass filter" display.

The key issue here is what is recorded from the HDTV camera onto the digital master and not what is displayed on small screens. A transfer to 35mm film and subsequent projection on to a large screen can, for example, dramatically expose the latent differences in picture sharpness between these sampling structures. This portends what will shortly emerge in the form of new electronic large-screen matrix displays (where the pixel count is commensurate with the sampling lattice, and will thus portray the true MTF of the source picture). The trade-off ultimately descends to a business decision on the type of DTV service sought.

By Alan Keil

Alan Keil is vice president/director of engineering for Ikegami Electronics, Maywood, NJ.

Ikegami is a camera manufacturer. We design and manufacture interlace and progressive cameras. We are not a proponent of one scanning system over another.

To date, the progressive broadcast cameras Ikegami has manufactured are 480P 60 frames/sec; and while this format is typically categorized as SDTV, it is far from standard from the perspective of camera design. Basically, it is operating at double the scanning frequency of an NTSC camera.

Several years ago, we began the development program for a digital studio camera — the result of which is the successful HK-388W 16:9/4:3 switchable aspect ratio camera. The HK-388W is an NTSC or 525I camera. But as a sister product to the HK-388W, we simultaneously developed a progressive model, the HK-525. To use the same data rate for the DSP of the camera, the RGB video is separated into odd and even lines and expanded in time to the same clock frequency as its interlace counterpart. In effect, there are six video signals being processed: R/G/B (odd lines) and R'/G'/B' (even lines). An ultrawideband triax transmission signal delivers Y and Y' to the CCU (together with signal channel CR and CB). At the CCU, the signals are compressed in time to return to a progressive signal available in SDI and analog component. Interlace output is also provided, as well as 16:9/4:3 switchable aspect ratio.

Regarding trade-offs between the interlace HK-388W and its progressive counterpart, the HK-525 vertical resolution and dynamic vertical resolution are clearly better with the progressive camera. Meanwhile, the progressive camera, while based on the same DSP, requires more individual components and is more complex with a higher cost. Also, due to the requirement to transmit two 10MHz luminance signals from head to CCU, the maximum triax cable distance is less for the progressive camera.

Recently, Ikegami has developed new DSP components that operate at sufficiently high data rates to support HDTV. So, for the next generation including 720P, the approach of using time expansion/compression will not be used. The

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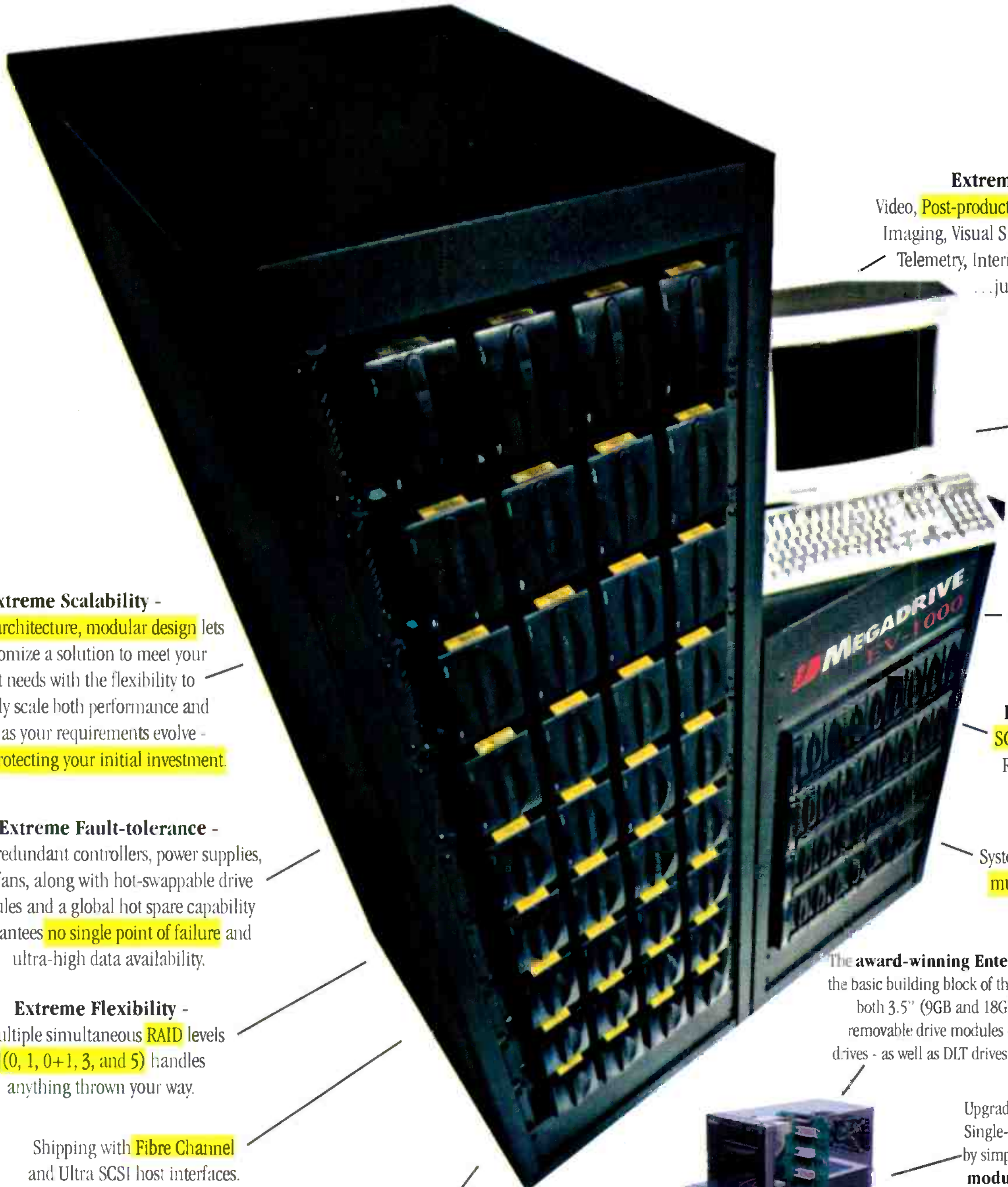

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video will be processed at full data rate from the CCD. From the camera design perspective, there will be little difference between the 1,080 interlace HDK-790 and 720 progressive camera. Both will require the use of fiber-optic camera cable to support the data rate requirement for camera to CCU transmission.

So, I think there will not be major trade-offs between interlace and progressive for Ikegami's HDTV cameras. Picture quality will be different, which is currently a subject of debate, and at this time, I cannot provide objective comparison data to contribute to this debate. Of course, there will be trade-offs compared to SDTV interlace cameras, with the HDTV cameras having a higher price and requiring fiber camera cable (it is an option on the HK-388W). The pros and cons of fiber vs. triax camera cable is a relatively long story and should perhaps be the topic of a future discussion article.


Dean C. Leeson


George Palmer

By Dean C. Leeson and George Palmer

Dean C. Leeson is business development manager, cameras, and George Palmer is product program manager, cameras, for Philips Digital Video Systems Company, Simi Valley, CA.

The most significant trade offs between progressive vs. interlace camera technologies occur in the areas of spatial resolution, motion artifacts and transmission efficiency.

• Resolution: Almost every recent test, objective and subjective alike, has verified that a progressive format image exhibits approximately a 50% greater spatial resolution than its equivalent interlace format image, based on an industry-accepted K(Kell) factor of 0.70.

• Motion artifacts: Since each scan in the progressive format produces a complete picture, the familiar flicker of interlaced pictures is virtually eliminated and motion artifacts are greatly reduced, while the scanning efficiency is increased. Freedom from artifacts is particularly significant in static shots and slow-motion sequences, which are essential for sports coverage and special effects. Motion artifacts are even more noticeable in interlaced images in HDTV resolutions (above a 0.70 K factor) and actually detract from the HDTV viewing experience. The same holds true for SDTV viewing.

What can we expect to gain from a 480p imager? In the full DTV mode we can produce an image with a 50% increase in spatial resolution over the current 480i cameras with no interlace artifacts, while at the same time eliminating those nasty NTSC chroma crawl artifacts. Even in current standard-definition applications there are, surprisingly, some impressive benefits.

It is helpful to know that the ATSC encoders, which enable the use of all of the accepted HDTV formats from 480 to 1,080, interlace and progressive, make use of an additional, supplementary vertical interpolator only when it detects an incoming interlaced signal. That interpolator has a somewhat deteriorative, negative effect on the output resolution of the transmitted interlaced signal, but has no effect on a progressive signal, as it is not applied to any incoming progressive signal. It is a fact that progressive derived images are far easier to compress than interlace images.

• Production costs: So far, it seems clear that after an objective technical evaluation, most evaluators would lean toward the use of a progressive image format, but one more subject should be viewed as it relates to practical implementation — the cost of doing production business in the DTV/HDTV world.

A wide range of technology implementation possibilities are available to a program originator, from upconversion from existing NTSC 525 (480i) signals to the use of new, native 1,080i production, processing, post-production systems. Even if we ignore the possibility of using lesser (than 1,080i) formats to achieve multicasting income streams, we cannot ignore the difference in the cost of equipment used in the different format schemes. For example, the average TV station, to completely re-equip in a 1,080 scenario, will be forced to replace all of its existing equipment with a new $25 to $35 million facility.

Now that the timeline for DTV implementation is finally in place, many broadcasters, TV producers and TV production facilities providers (e.g., rental houses and mobile units) are beginning to realize that a realistic business model may not exist to support these new mandated facilities. Historically, networks and advertisers have been unwilling to pay more for higher-technology production tools.

A 1,080 signal occupies all of the available compressed 1.5Gb/s datastream bandwidth. This would leave little if any additional bandwidth or additional revenue possibilities, such as multicasting, datacasting or even pay-per-view opportunities. More important, it requires the use of new production, processing and post-production facilities that are capable of handling that bandwidth. "}'Any analysis of HDTV within the DTV paradigm follows the same general mandates of the DTV model: bandwidth required vs. the cost of that bandwidth.

Some might ask why the same thing couldn't be achieved with an upconversion of a standard interlace signal to a progressive signal. It is important to understand, that upconversion of an interlaced signal to a progressive signal is not the same as capturing a progressive image at the camera sensor. In an interlace capture, there exists a motion phase error due to the fact that field two is captured 1/60 of a second after field one. Vertical filtering is then done on the image to minimize the interlace flicker, however, at this point, interlace artifacts are permanent within the image and will not be removed by upconversion. With the Philips True Frame Capture technology, our image starts as a pristine full progressive frame with no interlace artifacts. On the other hand, the unconverted interlaced signal and the 1,080i

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THE BIG PICTURE

signals attain no such benefit at either end of the processing chain, as both suffer from embedded interlace artifacts that contaminate the image from the start, with no hope of removal further down the processing chain.

By Phil Livingston

Phil Livingston is assistant general manager, technology and systems development, for Panasonic BDSC, Secaucus, NJ.

Because the difference between interlace and progressive does impact TV cameras, this issue does require discussion. However, I am sure those who understand camera technology far better than I do will examine those issues. That said, I would like to address the fundamental interest in progressive for field acquisition in an interlace world and then the interest in progressive for film transfer.

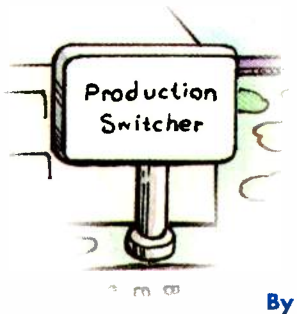
Panasonic has seen considerable interest in 480 progressive DVCPRO. Many will recall the prototype units we displayed last year at NAB and we will exhibit our first production products at NAB '98. From what does this interest stem? Certainly, few believe 480 is high definition and neither do we. Although the increase in temporal resolution is dramatic, the actual number of samples per line is the same as conventional standard definition. The answer is actually simple.

In the systems of the future, many people can see the need to upconvert field material to match a higher-resolution studio production format. Many facilities will have an HDTV studio and will also have the need to integrate field material. If the field acquisition is progressive, there is no "interlace footprint" in the signal. Simply put, progressive will upconvert better than interlace, especially if the higher-order signal structure is interlace. Therefore, if I imagine a 1,080, facility that wants to integrate news material, 480p may be the right choice for field acquisition.

At NAB '98, Panasonic will show the AJ-PD900W camcorder. This unit allows the user to select 25Mb/s DVCPRO or DVCPRO 50 (50Mb/s), 4:3 or 16:9 aspect ratio and 480 interlace or 480 progressive. (Progressive is only available in 50Mb/s). Noteworthy is the fact that this camcorder uses the same M_FIT CCD pick-up device as the AJ-D900W, an interlace only DVCPRO camcorder. The clocking scheme is simply changed to allow either progressive or interlace output.

The "M" in M-FIT means multiple transfer. There are actually two field memories in this state-of-the-art CCD assembly. Signals from every other row of pixels are sent to the opposite memory simultaneously. During the progressive mode, single lines from each memory are alternately clocked out. In the interlace mode, the entire contents of the first memory are clocked out followed by the entire contents of the second field memory.

Looking to Hollywood and film transfer, there is a strong desire to eliminate interlace and to eliminate the 3:2 pulldown. If video was 24 frames per second, you could have a one-to-one match between film frames and TV pictures. While 1,080/60 progressive may not be practical, 1,080/24 progressive might well be. Once the frame-for-frame relationship is established, all the electronic techniques can be used to create a frame rate more acceptable for televiewing — and this can be done at the sending end or at the receiving end in the "intelligent" receiver or set-top box of the future. Therefore, many people believe progressive is really a progressive way to go.



Question:

How important is HDTV capability or the option to upgrade to HDTV when considering production switchers and effects systems?

By Guy Walsingham

Guy Walsingham is vice president of marketing, North America, for Quantel, Darien, CT.

As we look at the challenges and opportunities that high-definition television offers, we enter an exciting and confusing era. Many fundamental questions remain to be answered. For those investing in post-production equipment, one of the foremost of those must be what HDTV actually will be and when will it become an economic reality?

The question, of course, is not as simple as whether high-definition switchers or effects systems should be considered. The quality and performance of those systems and the required investment also need to be carefully weighed.

With the look of a station being a vital ingredient in its success, on-air graphics have become even more complex. These creative advances have been forthcoming through the partnership of the creativity of broadcast designers and the technology available from companies such as Quantel. As a manufacturer, our philosophy has always been that there must be no compromise to this creative process. The importance of the creative content of programming will not diminish in the HDTV age.

Our belief is that the transition to HDTV will be over a period that is measured in years rather than weeks. 601 production and post-production will be around for a long time to come. The key for those investing in systems today is, therefore, to recognize a path from which they can expand or develop their facilities as the need arises. The time frame for large-scale full high-definition production will be set ultimately not by the industry, but by the consumer, purchasing sets for their homes.

At some stage, full-bandwidth HDTV production and post-production will become a rational step for the industry. In this interim period, however, simple economics dictate that completely retooling post-production and graphics for HDTV is not a realistic possibility.

At Quantel, we believe that there is a viable path from the present to the high-definition broadcaster of the future. Our experience in manufacturing systems for the film and print industries has taught us a great deal about working with images of far higher resolution than those required for high-definition television. Quantel's Graphic Paintbox, for example, is a creative design and retouching system for print images working in real time to output files of 14,000 by 14,000 pixels. The Quantel Domino is a creative compositor for film that again is required to work with 24 frames per second each of which is approximately three times the size of a 1,920x1,080 HDTV image.

Our experience has proved that 601 material, if properly treated, is quite satisfactory in a broad range of HDTV applications. All Quantel systems are 16:9 compatible so that the correct aspect ratio is already present. Beyond this, the key is the manner and speed in which the material is processed to ensure that the quality requirements of HDTV and the broadcast deadlines are met. This is fully achievable with careful engineering and will provide the path by which the broadcast community can viably reach the HDTV world.

High-quality pictures without the stunning graphics and visual effects the consumer is now accustomed to will not succeed in today's sophisticated market. The challenge for systems manufacturers is to achieve the level of performance necessary to produce complex graphics and effects within an HDTV environment, while achieving deadlines that daily constrain the creative process. The wealth of creative talent that has been unleashed with the latest generation of creative video design and editing systems will demand similar performance in high-definition.

Quantel is committed to achieving this goal. Our commitment is to show solution-specific technology that will perform at least as quickly at high-definition, as the systems that offer such creative freedom at current standards. We will be showing the initial fruits of our HDTV research and development at NAB '98.

By Robert Wilson

Robert Wilson is vice president and general manager, broadcast production group, for Pinnacle Systems, Mountain View, CA.

At Pinnacle, we view the advent of digital HDTV program creation and distribution as a certainty. Developing a strategic growth path toward HDTV, while maintaining compatibility with legacy distribution infrastructures, is an imperative.

Our business focuses on three video market segments: consumer, desktop and broadcast. Using our industry alliances with high-profile partners, we are helping to evolutionize, as well as revolutionize, the process in which video gets created, captured, recorded, edited, enhanced and displayed. A number of new forces are already at work in all three of our markets that are advancing the deployment of digital high-resolution video solutions. With recent technology advances, such as Hitachi's all-format decoder announcement and Intel's embracing of DTV formats, the migration is clearly under way.

Contributing factors that will influence the market include the following.

- **The impact of computer platforms:** More content is being developed using standard PCs equipped with a Windows 95 or NT operating system and Intel processors. These platforms will be capable of creating and decoding most of the proposed higher-video resolutions with embedded solutions or via optional peripherals. PCs that are multi-HDTV standard functional will outnumber new consumer televisions by a vast amount for some time. They will also connect to existing video distribution channels, as well as emerging data-centric channels, such as the Internet. Investment in developing chips, components and software directed to high-resolution content display and distribution by organizations in the computer and related sectors is a multiple of that being directed to video-centric high-resolution solutions.

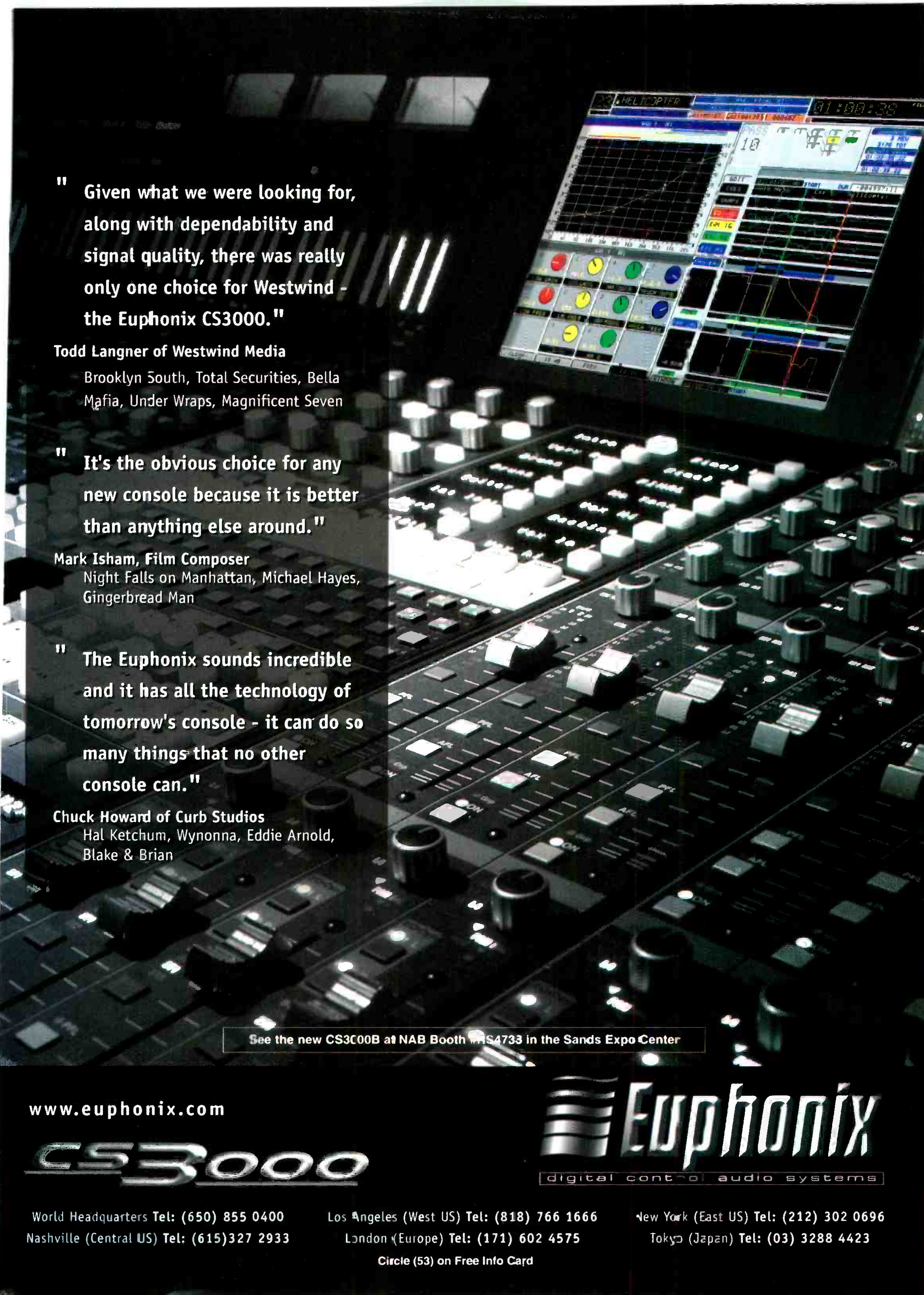
- **Low-cost digital solutions:** High-quality, low-cost content capture tools are becoming commonplace. Resolution independence is available for a fraction of what high-end analog systems cost just a few years ago. Digital content is easily re-purposed for multiple use and is routinely sent over standard networks, such as corporate intranets and the Internet.

- **Multiple resolutions will coexist:** The distribution infrastructure for resolution-independent content has been growing rapidly. The competition for viewers will continue to fragment the available audience. Bandwidth and content creation costs will need to scale to the economics of a program, meaning a single format cannot cover the economic needs of all program producers.

Consumers will determine the viable channels and formats. Investment will follow the viewing audience, but viewing habits change slowly and clear trends certainly will not be resolved at this year's NAB or even the next NAB. Inertia in this migration will mean existing distribution channels and standard resolutions will need to be supported for the near future.

Pinnacle is developing cost-effective, multiple-format video platforms, including resolution-independent content creation and on-air play-out solutions with the foregoing trends in mind. The next several years of transition will see multiple formats emerge as the channels of distribution continue to proliferate. Not all formats and all channels will prove viable. Existing video resolutions will continue to need support in order to address large segments of the viewing audience. Multiple compression techniques for distribution and editing will be employed to accommodate different approaches to digital and HDTV. Broadcasters especially will need to maintain flexibility as they transition toward the evolving HDTV multiformat and multichannel future. No single digital or HDTV solution will meet all of their needs.

Leveraging the investments being made by computer hardware and software companies is imperative if cost-effective migration paths toward digital HDTV are to be found. New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Solutions for the Embedded Audio Blues

In the past we have explained the difficulties encountered with systems that utilize embedded audio within the digital video stream. Those difficulties include the frequent inability to perform a clean switch of the audio content due to timing errors and confusion regarding the actual channel allocations in multi-channel audio systems. Current users will know these problems well by now and, although we have often provided explanations as to why these issues exist, we have never offered a solution.

The engineers at NVISION, Grass Valley, California, have pondered the technical issues in search of affordable answers for some time, and are now pleased to announce that, with the introduction of the new 4000 series of processing modules, they can finally provide the industry with the necessary solutions.

PROBLEM 1 – Noisy Audio Switching

When a switch is made between two video sources that contain embedded audio data, it is very difficult to resolve a clean audio transition at the receiver, due to two primary factors. (a) The audio data is commonly asynchronous to the video data and other audio channels. (b) In NTSC systems, any efforts to synchronize audio data with the video information can be lost if the video paths have differing processing delays. *See Fig 1.*

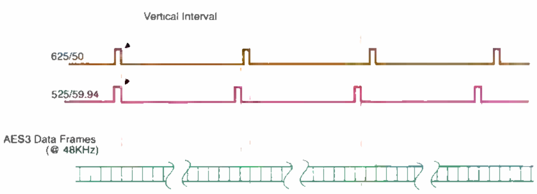


Figure 1: Timing Charts

CLEAN SWITCHING – The NVISION Answer

Unfortunately, it is impossible to ensure that all audio and video data is always correctly timed so that recovered audio framing is maintained. However, if audio framing is correctly timed at the insertion point, a higher percentage of error-free switching is achievable. In order to ensure satisfactory audio reception, it is necessary to take care of data alignment at the point of insertion and subsequently provide a method of error concealment at the point of extraction.

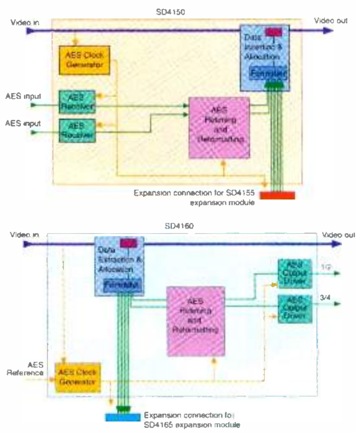


Figure 2: Internal diagrams of the NVISION SD4150 and SD4160

NVISION has developed new embedder and disembedder devices that incorporate our proprietary audio re-framing circuitry that ensure all audio data carried within each video stream is correctly timed. The output circuits provide constant AES framing patterns, regardless of input signal; this ensures that AES receivers maintain constant lock and eliminates aberrations due to receiver PLL recovery. Also, our error detection circuits within the disembedder ensure effective error concealment, regardless of the embedding method or device used during the insertion process. *See Fig 2.*

PROBLEM 2 – Arbitrary Channel Allocation

When more than four channels are required, the normal technique is to cascade embedders together. This process relies on the ability of the embedder to determine ancillary data content and decide where to allocate its audio channel group data. Receiving disembedders are also cascaded and must have a preset determination of which audio group to extract. *See Fig 3.*

The result of this methodology is that it becomes difficult to determine channel location as more channels are added. For example, the first channel pair from the first audio group may be received as the first channel pair of the second group, placing channels 1/2 as channels 5/6. The more channels inserted, the more difficult it becomes to determine location.

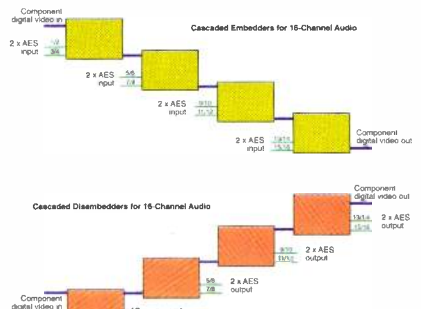


Figure 3: Cascading Embedders and Disembedders

DETERMINED CHANNEL ALLOCATION – The NVISION Answer

The new NVISION SD4150 Audio Embedder module provides for one group of four audio channels to be inserted into the SDI data stream. (This is similar to other available products.) However, if more than four channels are desired, another module (the SD4155) provides for an additional twelve audio channels (three groups) to be directly fed to the SD4150 for allocation

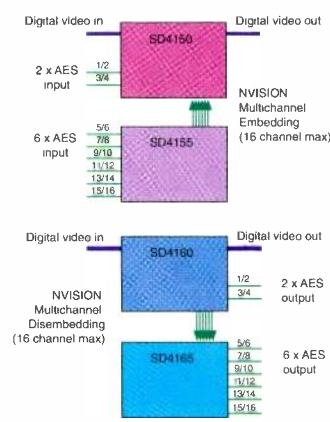
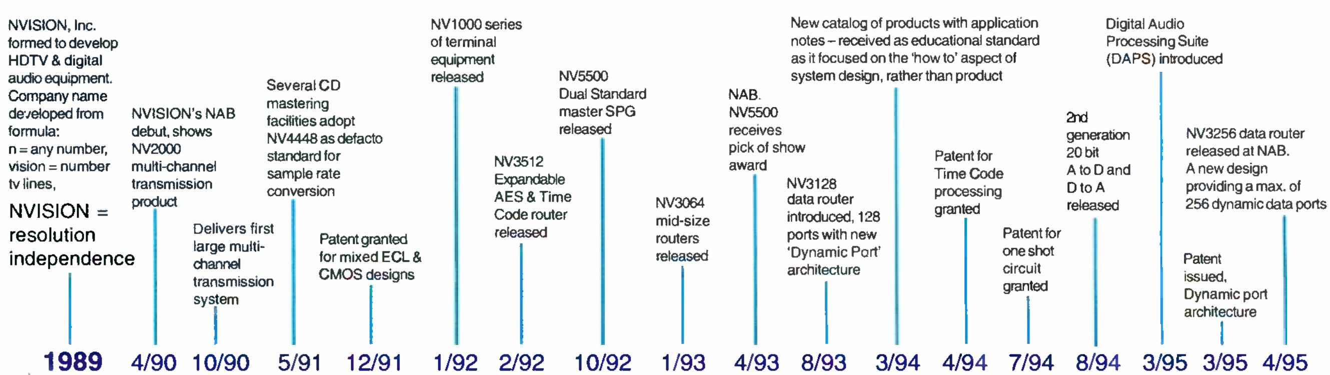


Figure 4: NVISION Multichannel Embedding and Disembedding (16 channel max)



In the Pink with the Latest DTV Processing Modules

Newly developed specifically for the DTV environment, is the 4000 line of digital signal processing modules. This new line is based on a choice of two rack mount module frames, the FR4001, a 1RU frame that holds up to four modules and the FR4002, a 2RU frame to hold up to eight.

These new frames have been designed to accommodate the latest in high speed processing modules for HDTV signals as well as our traditional processing products, while remaining compliant with US and International safety and emissions regulations.

The basic module layout is a departure from our previous designs, as each module is mounted horizontally in the frame and is a double width board. This new layout allows us to incorporate complex designs or to include dual processes on a single module. For example, our new 24 bit AES A to D (DA4030) contains two individual A to D's, allowing us to supply the highest quality of processing module at lower cost and greater utilization of rack space. The successful NV1000

and insertion. This method provides two benefits: 1. The exact channel group location can be determined by the single embedder module. 2. "Piggy-backing" embedders is unnecessary; therefore, costs are drastically reduced. ***See Fig 4.***

The disembedder (SD4160) module can detect the presence of channel groups and allow the operator to select which group to extract. If the embedded data contains multiple groups, the addition of an SD4165 expansion module allows a single disembedder to extract all channels in the order received. If the data was inserted by an NVISION SD4150, then all channels are extracted in the order inserted and therefore no operator intervention is required. If the data was inserted by another manufacturer's product, then the operator can select which group appears at each set of outputs. A further feature of the disembedder is the built-in, monitoring quality D to A converter and mini headphone jack, for convenient output channel assignment. ■

2RU frame can hold up to twelve individual modules, but the FR4002 can provide sixteen A to D processors in the same space.

The following is a listing of 4000 Series products that are being introduced during the first half of 1998:

New Equipment Frames:

FR4001 — 1RU frame with optional redundant power supply will accommodate up to 4-4000 series modules.

FR4002 — 2RU frame with optional redundant power supply will accommodate up to 8-4000 series modules. Includes alarm function.

New Processing Modules:

DA4010 — AES fan-out distribution amplifier. 1 input with loop, 8 outputs (twisted pair or coax options).

DA4011 — AES jitter removing distribution amplifier with reclocking and EQ. 1 input with loop, 8 outputs (twisted pair or coax options).

DA4030 — Dual AES A to D converter. Superior performance, 24 bit converters with sample rates from 28 to 96Khz. 2 individual stereo analog inputs. 2 AES outputs per stereo pair.

DA4040 — Dual AES D to A converter. Superior performance, 24 bit converters with sample rates from 28 to 96Khz. 2 individual digital AES inputs, 2 stereo analog outputs.

SG4410 — Master Digital Audio Reference Generator. Will generate constant digital tone and silence at 44.1/48Khz or 88.2/96Khz as well as SDIF (wordclock). Can lock to PAL/NTSC/HD 1125-60/59.94 or 750-60/59.94 as well as AES or SDIF inputs. Will provide phase accurate outputs from audio input reference.

SD4110 — Digital Video distribution amplifier. 270/360 Mbits, 1 input, 8 outputs.

SD4111 — Digital Video distribution amplifier with reclocking. 270/360 Mbits, 1 input, 8 outputs.

SD4150 — 4 Channel AES audio embedder. For insertion of 4 audio channels into a SDI video data stream. Includes NVISION re-framing technology to ensure correct audio data alignment.

SD4155 — Expansion module for SD4150. Allows for the addition of up to 12 audio channels (6 AES inputs) and ensures channel allocation and timing is maintained.

SD4160 — 4 Channel AES audio disembedder. For the extraction of 4 audio channels from a SDI video data stream. Includes NVISION re-framing technology to ensure correct audio data alignment as well as 'switch point' error concealment.

SD4165 — Expansion module for SD4160. Allows for the extraction of up to 12 additional audio channels (6 AES inputs), providing a total of 16, and ensures that channel allocation and timing is maintained.

HD4270 — 1.5 Gbit Electrical to Optical converter. Provides conversion of 1.5 Gbit serial video data on coax to optical for signal distribution by fiber. Required for any installation where 1.5 Gbit signals need to be received at 100 meters or more.

HD4271 — Optical to 1.5 Gbit Electrical converter. Provides conversion from optical signals sent over fiber to 1.5 Gbit serial video data via coax.

HD4272 — Optical to Electrical / Electrical to Optical converter. Provides for bi-directional conversion of 1.5Gbit serial video signals from coax to fiber & vice versa.

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5/95 Major broadcaster selects NVISION synchronous audio routers for 96' Summer Olympics

8/95 The first NVISION guide book, *The Video Engineers Guide to Digital Audio*, published

10/95 Patent issued, phase comparator circuit for bi-phase coded signals

11/95 New ASIC chipset developed for AES audio synchronization and re-framing

3/96 First routers delivered with SMS7000 node controller

4/96 *THE BOOK, An Engineers Guide To The Digital Transition*, released at NAB

4/96 NV3064SA, synchronous AES router introduced at NAB

7/96 *THE BOOK* supplied as reference material to UCLA, Utah State and Northwestern University

9/96 Patent Issued for Time Code signal processing design

10/96 Awarded contract to build a massive synchronous routing system for government agency. Switch sizes 2048 x 512 and 1024 x 1024

3/97 Precision Broadcast Interface (PBI) specifications created

4/97 FCC announces DTV decision, with schedule for introduction

4/97 New catalog issued at NAB 97'. Received Pick of Show Award at NAB 97' for PBI

5/97 Patent issued for a multiple frequency oscillator circuit

11/97 Engineering tests with 1.5 Gigabit circuit designs show success

1/98 Designs for new modular processing systems near completion

2/98 High speed routing design architecture verified and finalized

3/98 Finishing touches applied to major new product introductions at NAB98'. Approximately 20 new products prepared for announcement systems for graphics, image storage and management, as well as digital video effects, will need to be capable of supporting multiple formats, and be as resolution independent as possible. They must also be easily integrated with video and data transmission channels to accommodate a changing viewing audience. To foster a rational approach to digital HDTV, Pinnacle's investments in technology are all based on standard computer platforms and operating systems. We are also advancing video capture and compression techniques on a variety of fronts. We already provide broadcasters the ability to integrate graphics, images and effects over standard video and data networks, such as the Internet using our BroadNeT approach to systemization. Our approach to solving these difficult issues is gaining momentum as we have tripled the size of our company over the past year, while increasing customer service levels and profitability.

By Ed Fraticelli

Ed Fraticelli is director of engineering at Production Masters Incorporated, Pittsburgh.

As HDTV becomes a reality, it will become important for dedicated production switchers and effects devices to be offered by manufacturers in high-definition models. This will be especially important for live and master control switching, which will require button-per-input operation and real-time effects.

As workstation-style post-production systems are developed, though, going to high-definition digital video capability will become a matter of changing the input and output electronics and possibly upgrading to faster processors and disk arrays. The operational end of the system is comprised of software, which would remain the same. This has been the case with editing systems, such as Discreet Logic's "Fire," which was shown at this past summer's ITS Forum, in a high-definition arrangement. The user interface and software was the same as a standard-definition system, with a high-end SGI computer and some large disk arrays. (And, a high-definition, wide-screen monitor, of course!)

The problem with high-definition television, as it now stands, is defining the definition! At this point, there are several forms of HDTV that could become the "standard" for DTV: 1,080 vs. 720; progressive vs. interlaced; 60 frames vs. 30 frames vs. 29.97 frames vs. 24 frames, etc. Any combination of these and other parameters will require a different set of dedicated switcher and DVE electronics. General-purpose-based systems could possibly switch between different resolutions and frame rates, through software alone, as long as the base hardware has the necessary bandwidth.

One arrangement that could possibly work for live switchers would be a system that could switch over to different sets of processing electronics from one control system. In this way, a switcher could be used at SDTV resolutions in one instance and switch to 1,080i the next, by simply acquiring control of that set of circuitry. Although this would be an expensive arrangement, it could be more economical than building separate high-definition suites or trucks.

So, while it's prudent for us to examine HDTV capability for the future of our facilities, it would be dangerous, at this time, to attempt to "guess" what HDTV will be. And, unless a station or facility knows what resolution they will be using, high-definition capability in a switcher or effects system would be hard to correctly determine and obtain. Perhaps, instead, engineers should be looking into products that can be upgraded to HDTV in the future, without an extreme investment. And, if a switcher or DVE could be upgraded to HD, then operators who are already familiar with the control system could switch to high-definition systems without any retraining.

Question:

What are three of the key features buyers should look for when considering newsroom editing systems?

By Roland Boucher

Roland Boucher is senior product marketing manager, news editing and playback, Avid Technology Incorporated, Tewksbury, MA.

Non-linear editing systems have been designed to provide instant random access to audio and video — making non-linear systems faster and easier to use than tape-based systems. They allow users to increase productivity, flexibility and overall production values. Since the introduction of non-linear editing technology at the beginning of the decade, the technology has been primarily focused on long-form post-production. It has only been in recent years that non-linear editing technology has made its way into newsroom production.

For newsroom decision makers, there are now a number of non-linear systems on the market to choose from. In choosing a non-linear system that will provide advanced news editing, there are a number of features that a smart buyer needs to look for.

First and foremost, has the system been designed specifically for hard news editing? Most of the editors on the market today have been designed for long-form production. They are great in a post-suite environment, with multilayer effects and 16 plus channel audio, but are not designed for the high-speed, high-pressure world of hard news. A non-linear editor that is designed specifically for hard news editing should have all the tools necessary for producing feature pieces and promos, but needs to add the speed and efficiency required for hard news applications.

Second, the editing software should run on standard, off-the-shelf computers and integrated non-linear systems should take advantage of standard computer networking and stor-

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age systems. Proprietary systems add to the cost of acquisition and maintenance and quickly fall behind the rapidly improving price/performance curve of standard PCs. Upgrading a proprietary system is costly when and if the manufacturer decides to offer a new model. Upgrades for editors using standard PCs are offered at regular intervals and the customer may choose when he or she wishes to upgrade to take advantage of the improvements.

Third, the non-linear editor for news needs to be able to operate in a stand-alone configuration and as part of a larger, integrated news production system. The non-linear editor should offer a number of integration strategies: as a stand-alone configuration that will allow for a gradual transition from tape to disk-based editing and as part of a fully integrated, digital newsroom.

The news editor needs to integrate with a compatible playback system, as well as to a broadcaster's newsroom computer system, allowing script preparation, acceptance of shot lists and EDLs prepared on browsing and logging stations elsewhere in the newsroom. Larger integrated solutions require asset management systems that link metadata from different editors with rundowns and playback servers. Industry standards for metadata and its management are being proposed through standards bodies and a good non-linear editor needs to be based on models for these proposed standards.

Finally, with the current trend toward compressed digital acquisition systems, look for non-linear systems that are designed to accept data inputs from tape, as well as traditional analog and digital video and audio inputs for compatibility with older formats as well as the new. Editors that offer native media transfers direct from original field tapes to disk will mean no generation loss and the potential for 4X transfers for increased speed.

By Ray Baldock

Ray Baldock is director of product strategy for Tektronix' video and networking division, Beaverton, OR.

The Tektronix newsroom strategy is simple and based on practical solutions. Successful broadcast newsroom systems must reliably deliver high user productivity for reasonable initial and on-going investments that are protected over time. The useful life of the system (and hence the investment) is determined by the availability of flexible, expandable and evolutionary options for the application architecture and by the overall strength, maturity and stability of the newsroom vendor.

High productivity must be achieved with a rich set of specialized broadcast automation functions that are seamlessly integrated with each other. High reliability must come from redundant components, careful application design and industry-standard components so users can depend on the system to get the job done immediately and consistently.

With this in mind, Tektronix believes potential buyers must look for the following three factors: the ability to increase speed and efficiency of the overall news production process, the reliability of the system in transmission and the ability to scale the size of the overall solution.

Speed and efficiency increase with easy accessibility to wires, scripts, rundowns, archive material and facility resources, such as routers from within the edit station interface itself. The ability to edit feeds while recording them or edit directly from tape without having to ingest all the material before editing begins is also important.

A system's transmission reliability depends on a number of factors. Redundancy is key to ensuring back-up in the event of a catastrophic breakdown of a system. A system design that protects against potential transmission path and media failures is crucial. Also, in a fast-paced news environment, the ability to make last-second changes to the rundown reliably is essential to being first to market with late-breaking news.

Scalability of the overall solution is paramount. An open system architecture that is scaleable and modular must ensure interoperability between applications from different vendors. The number of simultaneous feed records, edit sessions and transmission channels a system can reliably handle is crucial. The system must support a migration path to new technologies as they emerge — dynamic technologies that will make use of traditional telecommunications facilities to more quickly access and transfer video data over greater distances to more people.

Tektronix' Digital Media Foundation™ (DMF) addresses all these issues. An initiative that brings into focus the need to systemize servers into a facility in a manner that provides improved efficiency in the creation and handling of contents, the DMF provides a distributed network of storage devices linked via audio/video routers and data networks, that provides an open system environment from applications ranging from editing and live production to on-air replay. The Tektronix approach automates and prepares news facilities to more quickly and easily store, move and manage material. It allows customers their choice of video server-based applications that best meet their specific business needs. The distributed environment allows expansion without limit and the option of adding redundancy only where essential.

In an industry where time is money, the DMF provides faster access to more material over wider areas and enables users to move and manage media throughout a broadcast facility, regardless of whether the data is stored on tape, disk or other device. The Tektronix DMF strategy increases the value of content by making it more accessible, speeds processing allowing time for greater creativity, increases efficiency and enables stories to be re-cut or re-purposed more easily than in a tape-only environment.

By Scott G. Griffin

Scott G. Griffin is a principal and the director of engineering for The Systems Group, Hoboken, NJ.

I think the three key features are transfer speed, media management capabilities and broadcast compatible architecture.

Transfer speed is a key element of breaking news coverage.

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splicing. This alone is a big issue that is just now beginning to be understood. In the good old days, you could switch on the next NTSC vertical interval. Not so with an MPEG-2 datastream. A multichannel system that is splicing MPEG-2 streams has to be intelligent and interactive with the datastream. Additionally, the facility management system will be required to automate data delivery, such as parental control, electronic program guides, subtitles, emergency messages, conditional access information and more.

From a business perspective, multichannel demands better automation. Putting that digital TV channel on the air requires a significant capital outlay and an operation without a significant increase in operational costs. This can only be accomplished with a facility management system capable of operating your analog and digital stations. So, build for tomorrow's eventuality today and gain the advantage of cost savings through better operational efficiency now. Get ready for that multichannel operation that is coming your way.

By Glen F. Sakata

Glen F. Sakata is director of product marketing for Louth Automation, Palo Alto, CA.

Someday, those of us who are participating in the revolution from NTSC to DTV, videotape to video disk, and single-channel to multichannel will look back at a time where less-than-mature technologies chased a number of moving targets. Where convergence meant overnight changes to hardware and personnel from acquisition to transmitter. Can you believe that your engineering and operations decisions are impacted by information services "experts"? And the Internet transformed into an indispensable tool for knowledge and communication that made us wonder how any of this was possible before.

You would think that automation companies would be scrambling for information on the latest hardware whether A/V record and playback devices, routers and switchers or those magical up/down/standards converters. At Louth Automation, this has been a continuous issue for us since we started in business. And we have been anticipating their arrival for some time. But rather than spend the limited space here to detail those items, let's throw some basic concerns out on the table:

Synchronous and asynchronous channels: Your program stream(s) may originate in NTSC, SDTV or one of many HDTV variants. Although a small minority of facilities (probably none) may be able to add resources to produce completely asynchronous channel outputs, the vast majority will need to deal with two or more signals that float between these two conditions on an event-by-event basis. The playback, routing and up/down/standards converting will occur at run time, not in a vacuum during traffic and scheduling or post. Management of these media assets begins prior to material arrival, is formatted for the devices available at that site, decisions about video and audio conversions and routing are established, and finally intelligent playback occurs. Frame-accurately. Spliced or not.

Run-time production: For those of you familiar with this term, run time represents the actual time of playback to air. Compositing, squeeze back credits, program and news promos and PSAs at run time are practical alternatives made possible by the generation of video file servers, switchers, keyers and effects generators on the market today. If you think your promo department is late now, wait until multiple formats and channels are added to their to-do list.

Real-time and non-real-time material transfers: While pointing to our white papers detailing position and implementation issues regarding video file servers and media transfer management, we cannot ignore the impact of video file servers and DTV. Video file servers have provided new flexibility and performance where tape handling could never suffice. Instant access and little maintenance have already endeared these products to users around the globe. But I/O limitations and prohibitive disk storage costs have created a natural demand for interconnectivity and inexpensive storage. Owing to the computer industry, wide bandwidth networking and digital tape robots (and you thought these beasts were gone from your lives), are on everyone's shopping list of the future. Be forewarned, non-real-time data transfer is not necessarily faster than real time. Network bandwidth can be overloaded and data movement may be slowed to a crawl. Digital archival tape management is referenced in total cycle time — tape mounting, data locating, transfer (here's your faster than real time bit), tape positioning for unmounting, unthreading and replacing the cartridge in the bin. Don't forget that the material had to get there using the same process/time.

The most successful facilities of past, present and future delineate clearly between traffic and scheduling, automation and device manufacturers. Louth Automation can proudly say "been there/done that" in providing the crossover technology that combines the other elements into a cohesive force.

Oh, by the way, despite all the hype of S/HDTV program material and commercials, we need to go back to what truly separates this medium from the rest: live news and sports. Then it really gets interesting.

By Brad Gilmer

Brad Gilmer is president of Brad Gilmer & Associates Inc., Atlanta.

Every station will be faced with a multichannel scenario sooner or later. You might say, "I'm not going to run multichannel." What about the FCC mandate for a simulcast of NTSC and DTV? True, this may not require additional equipment, with the exception of an up- or downconverter, but it still requires proper planning if you want to get good results.

For those anticipating a multichannel approach to DTV, you know you will have to build a multichannel facility eventually. The question is whether you should start now or later. Another question is whether automation will be part of your strategy. My advice would be to start building for

multichannel now and definitely include automation in your multichannel plans.

Why build now?

Multichannel operations will take more space. I do not know about your organization, but in the organizations I am familiar with, space is the number one issue in the facility. You should start planning for more space now since it may take time to get it.

It is less costly to install a multichannel facility now and run it as a single channel than it is to build a single-channel facility now and expand to multichannel later. There are many ways you can save money during the single-channel operation, such as buying partially populated router frames. This allows you to build the multichannel facility as you go. However, if you do not plan it this way, you will end up redesigning your master control facility from the ground up every time you add a channel. There is a better way.

Multichannel technology is relatively mature. It is the least likely part of the DTV equation to go through major changes between now and your DTV implementation date. If you are anticipating running part of the day as a multichannel DTV operation, you will have your hands full converting your transmission facility to DTV. Building a multichannel facility now gets part of the DTV conversion out of the way early so you can concentrate on more volatile areas of the DTV equation later.

Why implement automation as part of your move to multichannel?

Most stations I have talked to do not plan to add large amounts of staff to support the upcoming conversion to DTV. If you are planning to originate multichannel from your facility at some point in your DTV plans, it seems that automation is an absolute requirement. Automation will allow you to run a multichannel facility more efficiently. You may not be able to move from a single-channel to a multichannel operation without adding personnel, but automation will reduce the number of additional people you will need.

Automation will improve the look of your multichannel operation. Since most stations are not going to be able to quadruple their on-air staffs when they go to multichannel, it is inevitable that the on-air look of the channels will suffer. That is, unless a station employs multichannel automation, it is just about impossible for a human to keep up with more than two channels at a time using manual switching and a paper log. Add another channel or throw in a couple of live sports events on the channels, and things head down hill rapidly. Automation frees your people from the manual work of switching so they can concentrate instead on what is actually going out over the air.

If you are considering moving to an automated multichannel environment, another argument for starting the process now is that you will be facing a "double-humped" learning curve when you move to the automated environment. First, you have to learn how to integrate automation into your existing single-channel operation. Then you have to learn the nuances of operating automation in a multichannel environment. Automation is the way to go for multichannel, but it takes work to get there. If you anticipate that it will take a little time to integrate automation into your environment, and start early, you will be ahead of the game as you transition to DTV.

Question:

Is the ability to mix and process AC3 digital audio required for DTV?

By Steve Lyman

Steve Lyman is senior broadcast engineer for Dolby Laboratories, San Francisco.

No, because right now the majority of TV facilities are two-channel analog and do not have the signal paths for the metadata needed to make the ATSC audio system operate to its full potential. Even given an AES/EBU digital audio infrastructure, the lack of a metadata path makes it impractical to route AC-3 encoded audio data through the facility. There is another factor; AC-3 rate reduction has been optimized for low data rates rather than for cascadability. It is primarily an emission coder, intended to conserve spectrum between the transmitter and the home receiver. Signals can be AC-3 encoded for transport, then decoded to process and mix them with other signals then re-encoded to distribute them to the next users, but a coder specifically designed for many encode/decode cycles will consistently deliver better quality at the end of a broadcast chain than one intended for emission use.

"Consistently" is the key word in this situation. Artifacts generated by perceptual data rate reduction systems (audio and video, for that matter) depend on the program material being encoded. There is no reliable way to tell beforehand if a specific number of encode and decode cycles will cause problems for a particular piece of program material. It is, however, necessary to process the signal several times in the contribution chain (when the program segments themselves are being constructed) and in the distribution chain (when finished segments are being assembled). The best quality will consistently be achieved when the broadcaster uses a rate reduction system that is specifically designed to be cascaded.

As might be expected, Dolby is developing a distribution coder for multichannel DTV sound. It will carry six to eight channels of audio in a single AES/EBU pair and survive eight to 10 generations of encoding and decoding. It uses rate reduction to fit the audio data into the "audio payload" space of the AES/EBU signal. If the data uses only the first 20 of the 24 available bits, the encoded signal can be recorded on common digital VTRs, eliminating another of the existing bottlenecks in the system.

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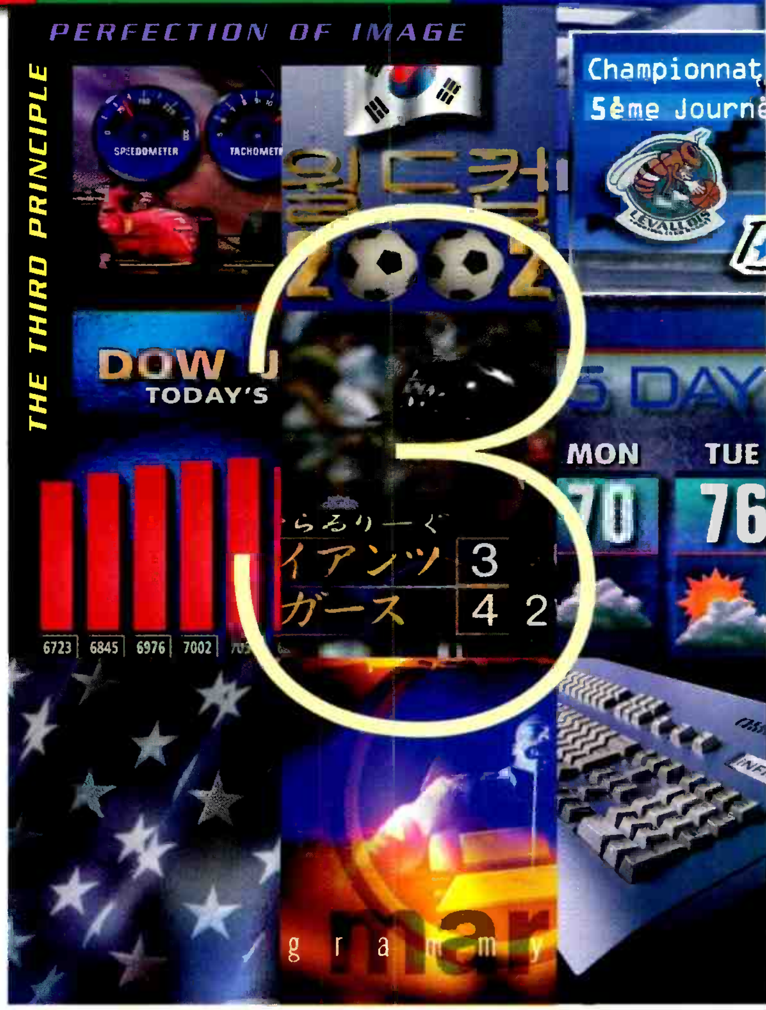

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The ATSC audio specification depends on having some information or metadata that describes the audio program itself accompany the program data to the receiver. It includes information about the number of channels being broadcast, the physical arrangements of the channels, dynamic range information and timing information required to maintain audio to video synchronization. The metadata is carried to the receiver as part of the transport stream, so it has to get to the emission (AC-3) encoder along with the audio. Existing TV facilities don't have a path for the metadata, so space has been reserved in the distribution coder signal for it.

Given a facility with one layer of AES/EBU signal routing, the distribution coder provides a multichannel signal path, allows multiple encode and decode cycles and carries the metadata through the contribution and distribution processes to the emission encoder. All of which means that it is not necessary to process or mix the AC-3 audio required for DTV.

By Jim Starzynski

Jim Starzynski is a project engineer at NBC headquarters in New York.

Rather than a single event, the transition from analog to digital audio for DTV is a three-stage process. These stages include the following: 1) contribution, the creative process of producing audio; 2) distribution, the means of routing a signal internally or externally; 3) emission, the transmission or delivery to the end user.

AC-3 is a part of the final emission portion of the process and is the ATSC-accepted and standardized technology that will be used to transmit audio into the audience's home. However, it is important to understand that it is just a part of one-third of the broadcaster's digital audio migration project. Each one of these three sections is a necessary step and will independently contribute to a complete digital audio program provided by the broadcaster and experienced by a listener.

Since 1986, analog multiplexed signals have been used to pass four channels of audio on a single stereo pair. These multiplexed signals can be routed through broadcast facilities and transmitted to an audience. The technology, commonly known as Dolby Surround Pro Logic contains left, center, right and rear channel information encoded as a two-channel signal called LT (left total) and RT (right total). This stereo and mono-compatible multichannel signal may be produced in-house or provided as a source, (i.e., a cinematic feature soundtrack). Either way, the two-channel analog format can be distributed on a standard stereo router, processed if necessary and transmitted to the home where it is decoded and reproduced as LCRS by the viewer's equipment.

What about the digital transition?

As the industry moves from analog to digital, the TV audience will witness a considerable leap in technology. Central to this transition is the concept of *audio perceptual coding* or *bit reduction.*

Just like the layers on a stereo analog router or the channels on a satellite transponder, the new digital path is an expense that must be managed and budgeted carefully, hence data reduction. The 5.1 multichannel digital signal in its original PCM form is bit rich (5.184Mb/s) and requires a wide (read expensive) digital path. Dolby AC-3 is a form of audio coding that compresses 5.1 audio channels (left, center, right, surround left, surround right and band-limited low-frequency effects channel) to a bandwidth a fraction of the original signal (384kb/s). This is accomplished by removing masked audio information that is not perceived by the human hearing system. It is an excellent solution that's optimized for bit reduction and lessens the required digital bandwidth. However, it has limitations.

For instance, if the 5.1 signal needs a voice-over, as might be the case with a network-provided movie that needs a local tag, the bit-reduced signal will need to be decoded, voice added and remixed then re-encoded. Unfortunately, only so much can be perceptually removed from a signal before distortion. Any processing requires a layer of re-coding. AC-3 was not intended for processing and mixing, which by its nature, requires decoding and recoding. It is optimized for bit reduction and one-step transmission.

So, what's a broadcaster to do?

This scenario of decoding and recoding will be a reality in our DTV world. However, because the audio portion of digital routing is standardized using the AES-3 format, this path offers a fairly wide bandwidth (3.072Mb/s). This lends itself to a more mixing and processing-friendly solution.

Enter a less bit-reduced technology: the distribution coding. Station voice-overs, remixing and coding artifacts are a reality. Therefore, a need exists to make the bit rich 5.1 signal fit into an affordable bandwidth and still allow for several decode and re-code operations. The solution is a coding process with less bit reduction designed for multiple tandems (eight to 10 times), but still easily fitting onto a single AES-3 channel.

Dolby Labs is developing just this type of distribution coding. This scheme will fit eight channels of discrete audio onto a single AES-3 channel permitting the broadcaster to decode, voice-over, remix or re-assemble and recode as required. This type of a compressed signal is packaged as AES-3 and meant to be used within broadcast facilities and passed from network to affiliate without degradation during subsequent processing. An outboard box will take the coded signal and decode it to discrete channels so it can be mixed and processed. Once processed, the signal can be repackaged with a companion outboard box and sent down the broadcast path. Eventually, these encoders and decoders may even find their way into consoles and monitoring devices.

What about the 5.1 channel AC-3 signal?

A digital audio soundtrack might use this distribution coding, be routed and processed by the network and then be sent to the affiliate. The station will process the signal and make their composite program. The now tagged and recoded program can travel again as an AES-3 package, ultimately becoming the source for the AC-3 emission coder. The ATSC AC-3 signal (ATSC document A/52) will provide the audio program for the viewer to decode into 5.1 discrete audio channels with frequency response and dynamic range unparalleled by current analog technology. ■


DTV:
Are you
prepared?

If you build it, WILL THEY COME?

You bet they will!

By Charles Waltner

The number one question on every station manager's mind isn't how do I build my DTV station. Engineers are solving that problem. No, the real question is, will anyone be watching?

In fact, it's a joke among those of us who follow the technology that there are more transmitters on the air than there are receivers to pick up the signals. Even during the CES, the number of working HDTV sets could be counted on a couple of hands. The fact remains, broadcasters are, as of today, ahead of the DTV game and that may be for the next couple of years.

Photo: HDTV displays, such as this plasma display from Pioneer, generated a lot of interest at this year's CES. (Photo courtesy of CEMA.)

Hello? Is anyone out there?

The adoption of digital television is inevitable — thanks to a government mandate. But, set manufacturers are proving to be enthusiastic accomplices in the mission to quickly establish digital television in American homes. Unfortunately, quick is a relative term in the electronics industry.

One look at the history of the VCR and CD player can tell you why. Both of these technologies, even with strong backing from manufacturers and the associated content industries, took eight years to reach a 20% to 30% market share. The question in the minds of station owners is will the rate of DTV adoption be equally as slow? Experts doubt it for several reasons.

First, the FCC has mandated an implementation schedule, so stations can't drag their heels. Second, the consumer electronics industry needs new products to sell and DTV is

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If you build it, WILL THEY COME?

that product. Finally, because of the relatively quick start by both industries, observers predict a slightly faster adoption rate for digital television.

Quick start for DTV

Josh Bernoff, a principal analyst at Forrester Research, said digital television will take eight years to reach 30% of American homes. But combined with DTV converter boxes, nearly 50% of American homes will have access to digital television by the year 2007.

Of potentially even greater importance is that satellite-delivered HDTV programming will be available this year. The January announcement by DirecTV that it would provide HD programming nationwide means that the entire country will soon be able to see HDTV. They won't have to wait for their local TV station to make the switch to see these high-resolution images.

The Consumer Electronics Manufacturers Association (CEMA) predicts that 20% to 30% of homes will have DTV sets by 2006. Other industry reports follow the same line of thinking. Todd Thibodeaux, vice president and senior economist for the CEMA market research department presents evidence of a relatively rapid adoption of DTV technology. Figure 1 illustrates the predicted growth rate for DTV's first eight years, compared to that experienced by color television. Note that in only eight years, DTV is predicted to have more than three times the penetration as did color television over the same time period.

Another factor in rapid adoption rate is the ability for consumers to buy set-top boxes instead of new TV sets. Although they will not get HDTV images, they'll still receive the benefits of multichannel and improved pictures, which will be visible on a modern set. This means consumers can sample some benefits of DTV early on, again helping hasten the adoption rate of new sets — and helping broadcasters leverage their investment in digital technology.

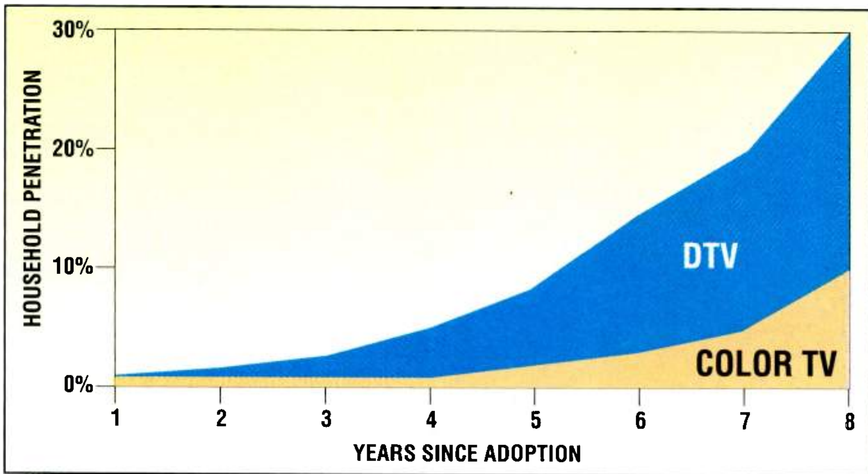

Figure 1. The predicted growth rate for DTV's first eight years, compared to that experienced by color television.

Set cost

It's true that the first digital sets will be expensive from the offset, but prices will fall quickly. Set makers typically release new-generation designs about every two years. This means there'll be lots of new options and features to tempt consumers. According to CEMA, 10 million households are spending at least $2,000 annually on televisions or PCs. Such expenditures bode well for DTV set purchases.

And, the entire electronics industry is throwing its weight behind DTV with every TV manufacturer heavily investing in producing DTV sets. Those showing products at the recent CES show included Zenith, Sony, Toshiba, Thomson, Mitsubishi, JVC and Philips/Magnavox.

Thomas Patton, a spokesman for Philips Electronics North America, said his company plans to debut a 64-inch rear projection digital TV set in time for Christmas. Philips hasn't finalized a price for the set, but Patton said it would be between $6,000 and $8,000.

Philips also plans to manufacture a 42-inch digital set with a direct-view plasma screen by the spring of 1999. That set will cost around $15,000, Patton said.

All of these predicted set prices need to be taken lightly. The reason is that manufacturers are hesitant to say exactly how much the new sets will cost for fear that consumers might put off buying analog sets if the prices for DTV sets are too low or scare away consumers if the prices are too high, said Robert Graves, chairman of the Advanced Television Systems Committee (ATSC).

Bruce Allan, general manager of the

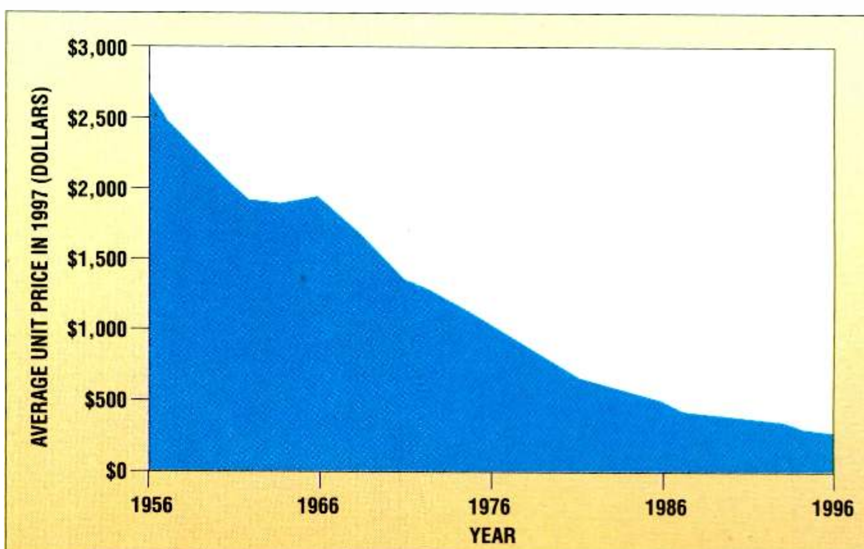

Figure 2. The inflation-adjusted price of color TV sets from its introduction in 1956 to 1996. Early color televisions cost $2,500 in today's dollars.

broadcast division at the Harris Corporation, sees reason for optimism. Allan said the $2,000 premium on DTV sets will fall to $500 to $700 in five years and to $200 to $300 in 10 years. "The electronics industry is a volume-based business," he said. Research seems to back him up.

Shown in Figure 2 is the inflation-adjusted price of color TV sets from its introduction in 1956 to 1996. Early color televisions cost $2,500 in today's dollars, not unlike some numbers we're hearing for DTV sets.

Buy one

Regardless of all the other technical concerns, initial DTV sets should prove to consumers the superiority of the technology over analog. "They will be awesome home entertainment machines," Forrester's Bernoff said.

Even with DTV set costs likely to remain high for several years, TV manufacturers take comfort in the home theater trend. More and more households are spending big bucks on big-screen televisions for converting their homes into mini-theaters. Today, more than 18 million households have paid $2,000 or more for a TV set, an encouraging statistic for DTV sales.

"The first receivers will deliver the worst HDTV consumers will ever see," said Robert Graves, ATSC chairman. Although some have interpreted that to be a slam at HDTV, Graves says that he only means that sets will quickly improve in operation and image quality. And, anyone who's seen HDTV knows that, even today, the images are little short of breathtaking.

Electronics retailers' enthusiasm about digital television are tempered, but still positive. Eric Ommundsen, spokesperson for the Future Shop Ltd., a Vancouver, B.C.-based retailer with shops in the western United States, said his company's success with other digital equipment introductions, such as DVD and digital satellite, bodes well for DTV. "We think there will be an audience for DTV on the first release of the product," Ommundsen said. He also noted that many of his customers already pay $2,000 to $3,000 for today's analog sets.

If you build it, WILL THEY COME?

The Electronic Industries Association estimates manufacturers will sell roughly 100,000 to 200,000 DTV units in 1999, with that volume more than doubling in each of the following few years.

Build it — they'll come

The only question for stations then should be how soon to board the digital train. It's already leaving the analog station for the final time and you don't need a first class ticket. There's plenty of room in coach and you can move up to better accommodations whenever you're ready. And remember, while many scoffed at Kevin Costner in the movie, "Field of Dreams," once he built it, the crowds did come. So too will they for DTV. ■

Charles Waltner is a technical writer for the electronics industry.

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POWER

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Cable's digital dilemma

By Robyn Griggs

When it comes to the cable industry's plans to provide HDTV to consumers, only one thing is certain: The picture is far from clear.

For the major players in the cable industry, the HDTV issue is interlaced with fuzziness and static. Will the FCC require cable companies to carry digital as well as high-definition broadcast signals? Should cable operators be required to carry the full complement of the broadcasters' digital signals, and if so, where does the primary video stream reside? Should channel capacity be redefined from the current 6MHz channel bandwidth for standard and analog NTSC signals to reflect digital transmissions? Should cable companies change their definition of "basic tier" to include broadcasters' multiple digital offerings?

Photo: Cable head-ends, like Southwestern Cable Television shown above, are already building the needed infrastructure to support broadcasters' multicasting and HDTV signals. (Photo courtesy of A.F. Associates.)

There's trouble brewing

"Digital TV issues, particularly those involving must-carry rights, are shaping up to be some of the most difficult problems that the FCC has recently faced in the video programming arena," Stephen R. Ross, a partner with industry consulting firm Ross & Hardies, told participants at the Society of Cable Telecommunications Engineers 1998 Conference on Emerging Technologies in January. "Technology, politics and policy all will clash head-on as powerful industries, including cable and broadcast companies, work to influence a regulatory process that is sure to leave some disappointed."

"Some people may not know what they should do because

they don't know what the rules will be," admits Bill Johnson, deputy chief of the FCC's Cable Services Bureau. "There are all kinds of really complicated, horrible issues involved....We're hoping that people are spending some time trying to work it out on their own, but I don't get a feeling a lot of people are in the nitty-gritty of it."

Johnson says the FCC will begin proceedings to "ask the questions and get the specific proposals" within the next couple of months. "Six months later, we would regard it as fast if we can make a decision," he adds. "And by that time, many stations will be on the air with high-definition."

The Telecommunications Act of 1996 specifically states that "ancillary or supplementary" digital TV services should not have must-carry rights. The U.S. Supreme Court ruled in March 1997 that cable operators must carry broadcasters' existing analog channels but said nothing about the new digital channels. Now it's up to FCC officials to decide how to treat multiplexed digital signals. Most industry observers expect that the commission will require cable operators to carry at least some of broadcasters' digital offerings, because 65% of TV households receive their signals through cable systems. Without that reach, HDTV is doomed. "I would guess that the commissioners will not want to just sit on this and let it play out itself. They will say something one way or another," Johnson predicts. He adds that cable companies should look at the potential benefits of must-carry rules. "I don't think I'd like to be a cable operator saying, 'Your neighbor's got fancy, high-definition signals, but you can't get it from me.' My assumption is that there's going to be a fair size of the market that's going to love this stuff."

The cable dilemma

Cable companies are discouraged by the possibility of digital must-carry rules, because they are concerned that if HDTV proves to be popular and every broadcast station offers it, they could have to add channel capacity by rebuilding their entire cable facility. The companies would rather use digital compression to squeeze more channels down the same coax, a process that is relatively inexpensive to do. They are also concerned about the cost of providing new set-top boxes to convert the signals, expected to run around $300 each.

Stephen Effros, president of the Cable Telecommunications Association, calls HDTV "consumer fraud," adding that the cable industry can't make plans to accommodate it because there is no proof of consumer demand and broadcasters are not yet certain how they will handle the spectrum. "Cable will deliver HDTV to consumers when the consumer marketplace says it is the appropriate thing to do — when it's clear that's what consumers really want as opposed to what the government says," Effros says. "Broadcasters demanded spectrum for HDTV and suddenly realized they'd been visited upon by that great Chinese curse: Be careful what you ask for, you might get it. Now they've turned around and said, 'Cable's got to carry it.' Carry what? For who? Why?"

> My assumption is that there's going to be a fair size of the market that's going to love this stuff [HDTV].

Still, the cable industry seems to be coming to the understanding that it is not politically savvy to appear as if it's standing in the way of politically favored HDTV. After claiming last fall that the cable industry would fight must-carry rules for digital channels all the way to the Supreme Court, National Cable Television Association president Decker Anstrom made an abrupt turnaround in December, telling reporters, "HDTV promises to be an extraordinarily compelling product. It would be a mistake for this industry not to be there if HDTV fully develops." Promising that cable operators would use up their scarce bandwidth to distribute HDTV, Anstrom added that broadcasters "are going to find partners in the form of cable operators in every market in the country."

"We, the cable industry, are in the process of purchasing set-top boxes," says Mike Schwartz, vice president of communications for CableLabs, a cable-backed research and development firm. "We expect to have prototypes, testing and certification of open cable boxes with some significant numbers available by early 1999."

Tele-Communications Inc. (TCI), the nation's largest cable carrier, led the cable industry in ordering 15 million advanced set-tops from General Instruments for roughly $4.5 billion. TCI plans to begin providing boxes that will pass through any high-definition format — whether 480P, 720P or 1,080I — by the middle of next year. "The story's pretty simple," says David Beddow, senior vice president of TCI Technology Ventures. "Any of the formats are capable of being passed through."

Adds Schwartz, "That is pretty much the cable industry's position. We don't intend to be a bottleneck in providing high-definition signals. We will pass through to a set whatever kinds of formats the broadcasters provide."

Time Warner, the nation's second-largest MSO, is "working with our hardware vendors to make sure we have digital cable boxes that can provide HDTV signals to all consumers in the top 10 markets this summer when the signals become available," says vice president of corporate communications Mike Luftman. Scientific-Atlanta is currently retooling 550,000 Explorer 2000 boxes so it can handle HDTV signals. "We've told our vendors what we need, and they're already in the process of developing digital boxes for us, but the process began at a time that predated the HDTV plans that have come out within the last year," Luftman explains. "They were not originally intended to pass HDTV signals, but they will be modified to do that."

Luftman says the boxes will pass 1,080I signals, because that appears to

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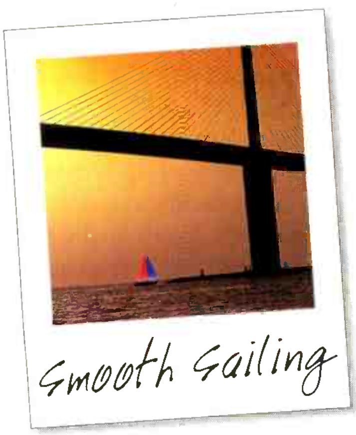
Bridge Over Troubled Waters.



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Cable's digital dilemma

be the standard that has been adopted by broadcasters. "There are no ifs and or buts about our plans," he adds. "It's only a question of when we receive these boxes. Obviously, that is in the lap of our vendors."

Roger Keay, vice president of technology and strategic planning for Rogers Communications in Toronto, says Canadians are taking a "wait-and-see" attitude. "We will not see HDTV until at least 18 months after the United States has it in the top 10 markets," he says. "From our point of view, it's not an issue that's going to be on top of us for at least two years, by which time the U.S. situation is going to be sorted out."

Despite the supportive assertions from some of cable's biggest U.S. players, most industry observers are less than convinced that MSOs have jumped wholeheartedly onto the HDTV bandwagon. "The cable companies don't want to do anything because they're not going to make any money from this," says Joe Fedele, president of technical advisory and broadcast engineering management firm Fedele and Associates. "They haven't been given extra bandwidth by the FCC, and they don't know if they'll be forced to must-carry. They are the reluctant bride with shotguns all around them. If they do HDTV, it represents a big expense. If they don't, the consumer will say, "Why should we have cable if we don't get HDTV?'"

HDTV [is] "consumer fraud," Stephen Effros, president of the Cable Telecommunications Association.

"I was under the impression that they haven't done anything with HDTV except a couple of projects with CableLabs," says Peter Krasilovsky, vice president of industry consulting firm Arlen Communications. "It certainly hasn't been an emphasis for an industry focused almost entirely on cable modems and telephony. HDTV certainly hasn't been a priority."

CableLabs is working on specifications for a family of open cable boxes that would provide everything from high-definition signals to Internet access and interactivity. "You could buy a box that complies with the open cable specifications that's like a Yugo or you could buy one that's like a Land Rover," he explains. An important factor, he adds, is that viewers can buy a box that works in Colorado as well as in Pennsylvania — it wouldn't matter who provides the cable. "There's an awful lot out there, not much of which has to do with high-definition — except that the industry doesn't want to be a roadblock there," Schwartz says. ■

Robyn Griggs is a technical writer in Boulder, CO.

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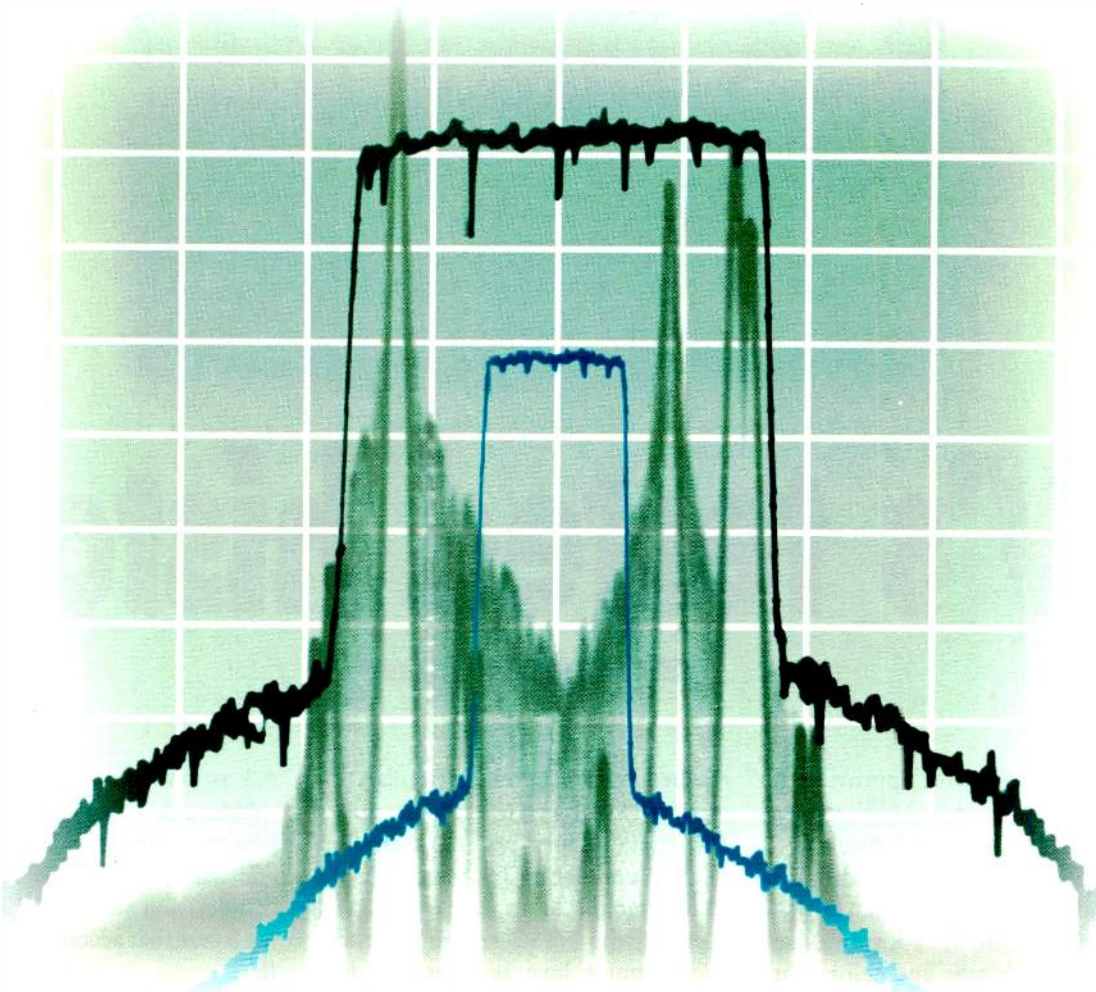

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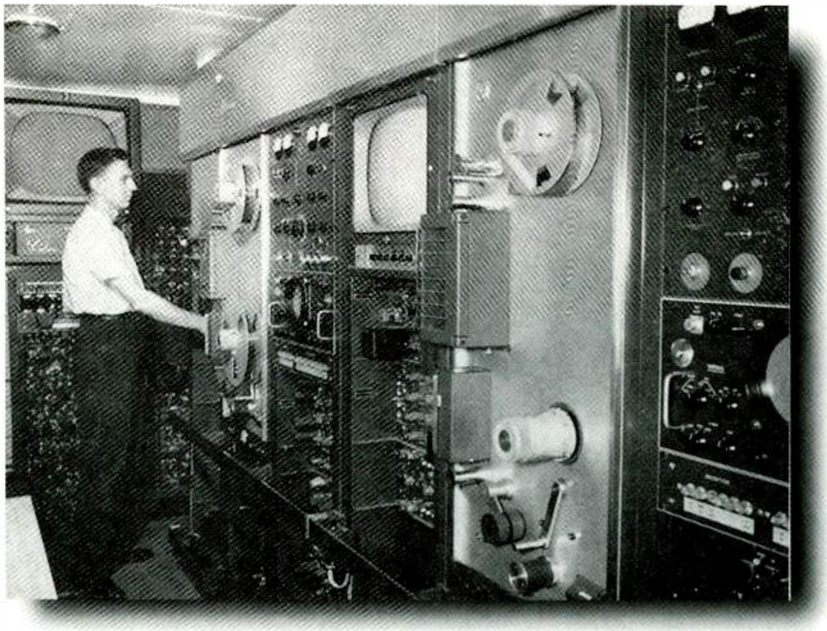


TV's tested history

By Jerry Whitaker

The FCC's action in approving the Grand Alliance DTV system paved the way for consumers to enjoy top-quality video and accompanying audio. The process began in 1987 and led to the third broadcasting standard — monochrome and color being the other two. Let's review the pioneering efforts.

Black-and-white standards

In 1936, the Radio Manufacturers Association (RMA), the forerunner of the Electronics Industries Association (EIA), set up a committee to recommend standards for commercial TV broadcasting. In December 1937, the committee advised the FCC to adopt the RCA 343-line/30-frame system.

In 1940, the National Television System Committee (NTSC) was established, which was placed under the sponsorship of the RMA.

A progress report presented to the FCC on Jan. 27, 1941, stated that it had reached agreement on the standard except for two points: the specification of 441 scanning lines per frame and amplitude modulation for the synchronization signals. At a meeting on March 8, 1941, the NTSC agreed to specify 525 scanning lines per frame and rewrote the portion of the standard concerning synchronization to permit frequency modulation.

Photo: By today's standards, videotape recorders like these, which stood as tall as a man, appear almost neolithic. Will HDTV appear as antiquated in 40 years as these old quads?

The report was delivered to the FCC on March 20, 1941, recommending adoption of the NTSC monochrome standard. The FCC adopted the standard on April 30, 1941, and ruled that commercial TV broadcasting based on the format would be permitted on July 1, 1941. Key elements of the standard included: the use of a 6MHz RF channel with the picture carrier 1.25MHz above the bottom of the channel and the sound carrier 4.5MHz above the picture carrier; vestigial sideband modulation of the picture carrier with negative modulation and preservation of the DC component; frequency modulation of the sound carrier; 525 scanning lines per frame with 2:1 interlace at 30 frames (60 fields) per second; and 4:3 aspect ratio.

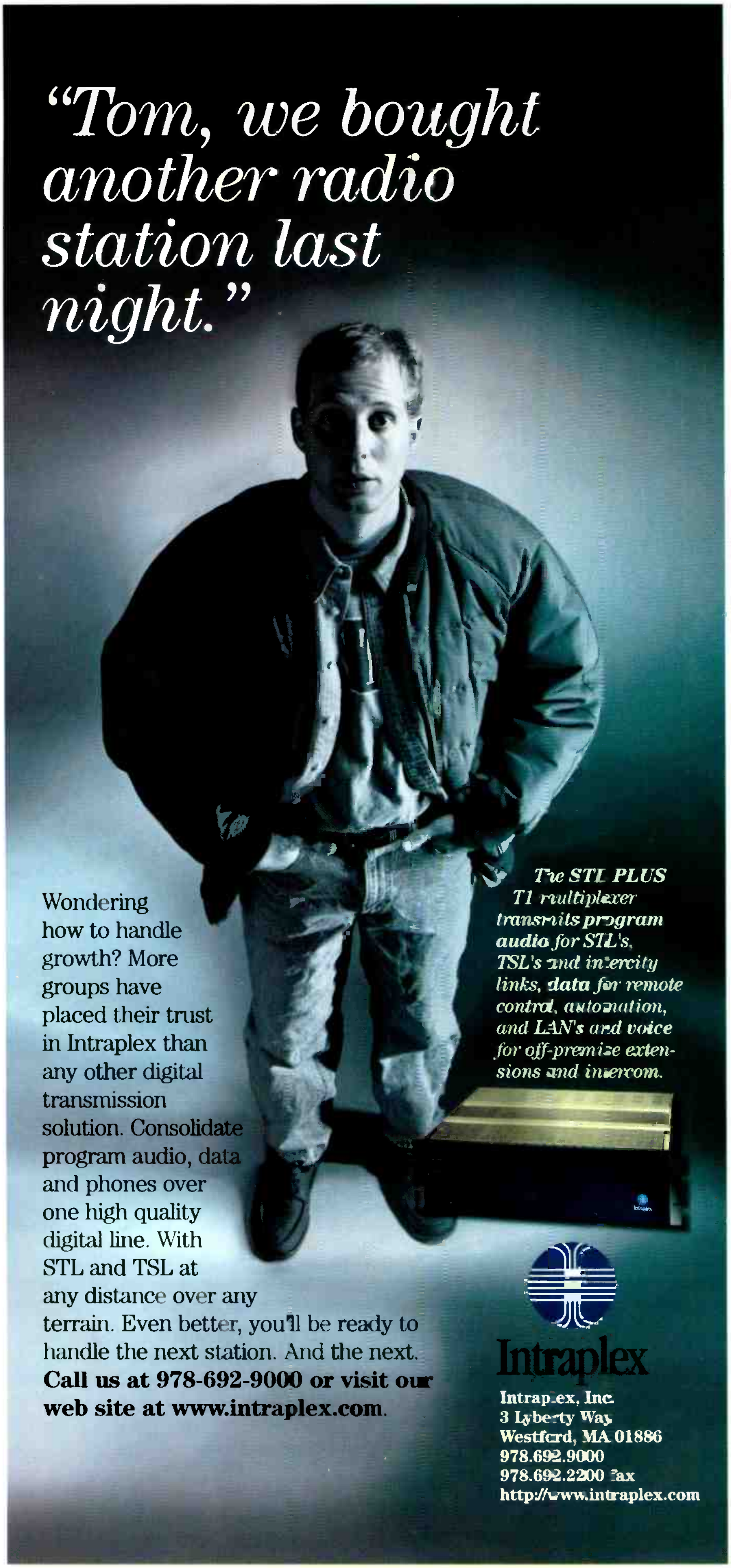
Although the FCC authorized the first two commercial TV stations to be constructed in July 1941, the growth of television was ended by the licensing freeze that accompanied World War II.

Color standard

During its development, it was assumed that color would be demanded by the public. Field sequential systems were demonstrated in 1929. CBS showed a field sequential (color filter wheel) system in the early 1940s. The CBS system was adopted as the color TV standard in October 1950.

The engineering community felt betrayed. Monochrome television was about nine years old, but with a base of 10 to 15 million receivers. Broadcasters and the public were faced with having their new and expensive equipment becoming obsolete. The wisdom was that color must be an adjunct to the 525/30 monochrome system so that existing terminal equipment and receivers could accept color transmissions.

The proponents of compatible, all-



TV's tested history

electronic color systems, were making advances. RCA had demonstrated a tri-color delta-delta kinescope. Hazeltine demonstrated the constant luminance principle, as well as the "shunted monochrome" idea. GE introduced the frequency interlaced color system. Philco showed a color signal composed of wideband luminance and two color-difference signals encoded by a quadrature-modulated subcarrier.

The RMA's technical committee (NTSC) was reactivated in January 1950. By November, a system employing the basic concepts of today's NTSC color system was demonstrated.

Field tests showed such defects as sound interference caused by the choice of color subcarrier. This was corrected by the selection of a different frequency, but at the expense of lowering the frame rate to 29.97Hz. Finally, RCA demonstrated the efficacy of unequal I and Q color-difference bandwidths. The proposal was forwarded to the FCC on July 22, 1953.

Demonstrations of the system were performed on Oct. 15, 1953, and on Dec. 17 of the same year the FCC approved the color standard. Color service began on Jan. 23, 1954.

It is interesting to note that the phase alternation line (PAL) principle was tried, but hardware to implement the scheme wouldn't be available until 10 years later.

It is worthwhile to consider the longevity of the NTSC color standard. From 1953 to the present, the standard has endured. The lesson to be learned from the work on NTSC Version 2.0 is that, unlike the black-and-white standard, the FCC acted according to its schedule, rather than waiting for the industry to pull its resources and solve the problems of color television. From 1950 to 1953, an all-electronic color system had become practical. If the FCC had waited for technology to catch up with the desire for change, the public would have been spared a lot of confusion over television. ■

Jerry Whitaker is a consulting editor and author of numerous reference books on broadcasting and technology.

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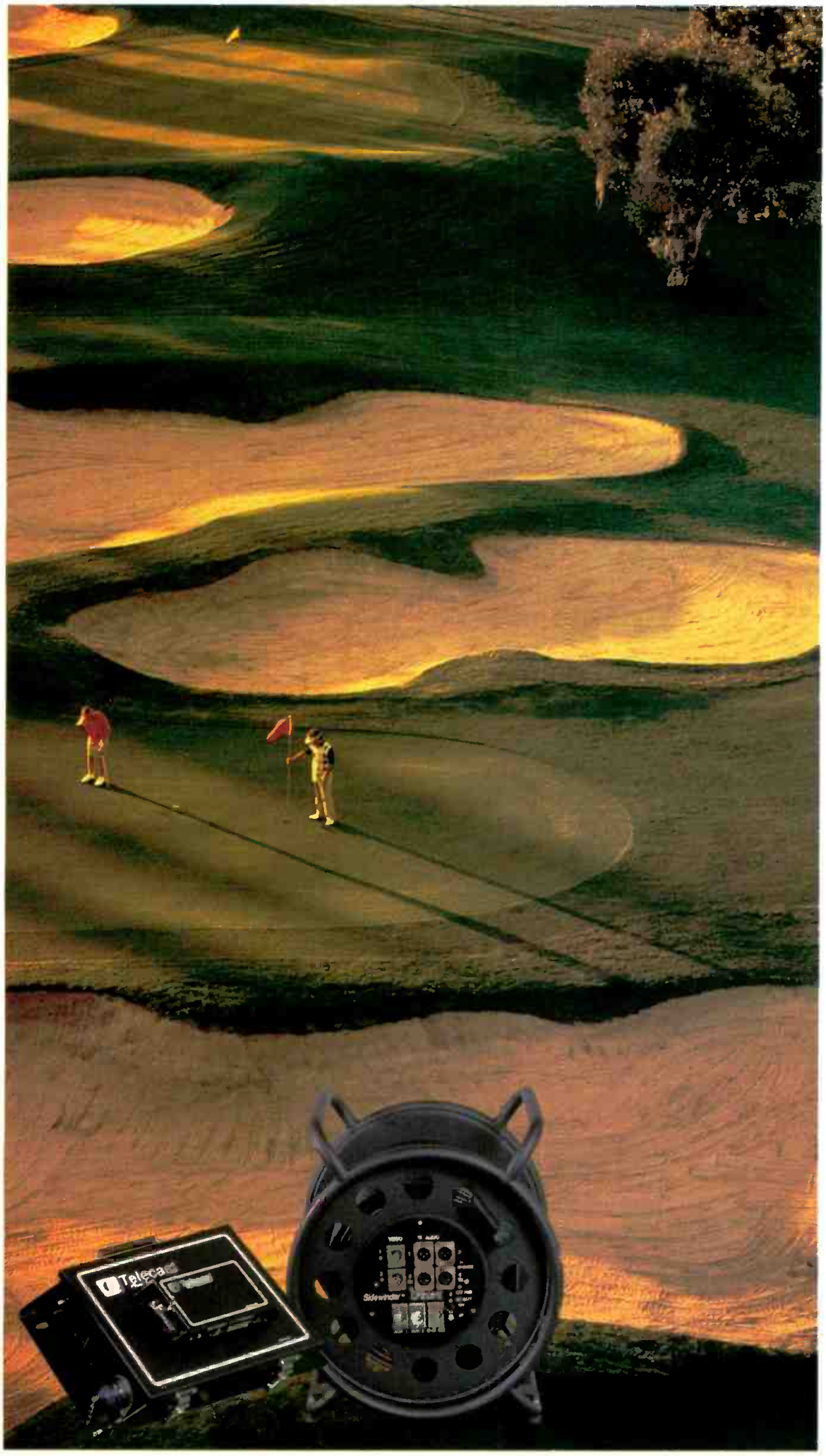

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ADJACENT-CHANNEL TECHNOLOGY

Acrodyne Adjacent-Channel Technology (ACT): ACT allows you to pass adjacent digital and analog signals through a single high-power amplifier; Diacrode and advanced tetrodes can be tuned to 12MHz, the bandwidth required for two channels; Acrodyne's booth will feature an ongoing over-the-air demonstration of an ACT transmission broadcast in analog and digital from KBLR-TV in Las Vegas; 215-542-7000; fax 215-540-5837; acrodyne@pond.com; www.acrodyne.com

Circle (251) on Free Info Card

DTV MARKETPLACE

NAB is the world's marketplace for new technology. And, this year's exhibition is even more special as station engineers go shopping for digital solutions.

To help readers find these new DTV products, *Broadcast Engineering* magazine went searching for this new technology way back in January. Vendors were asked to supply information about what new DTV products they'd be showing at NAB. The following items were released to *Broadcast Engineering* in advance of the show so readers could plan to visit these booths early.

So, here are some of the hottest new DTV solutions you'll find on the show floor. Products are arranged in alphabetical order by company. Avoid the crowds, see these products first. For other new technology and products, see "Sneak Peeks," which begins on p. 200.

VIDEO JACKS

ADC Telecommunications Super Video Jack Family: the performance of these video jacks is matched for data rates up to and including HDTV in the full uncompressed 1.485Gb/s rate; the standard-size SVJ-2 can handle bandwidths up to 2.4GHz; the midsize MVJ-3 can go to 3GHz and beyond; 612-938-8080; fax 612-946-3292; www.adc.com

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HDTV FILTERS

Allen Avionics HDTV filters: designed to be used in the digitalization of high-definition TV signals , these miniature filters are available in 40-pin dual-in-line packages for PC mounting; the filters are ideal for suppressing aliasing components in digital HDTV systems; 516-248-8080; fax 516-747-5724

Circle (253) on Free Info Card

TRANSMISSION LINE FOR DTV AND NTSC APPLICATIONS

Andrew 8-3/16-inch 75Ω rigid coaxial transmission line for DTV and NTSC applications: two patented versions, HRLine and MACXLine, are available each compensating for differential thermal expansion of the center conductor to reduce the risk of line burnout and loss of revenue; both provide double the longevity of conventional rigid line; HRLine eliminates bullet-type inner conductor assemblies completely; 708-349-3300; fax 708-349-5516; www.andrew.com

Circle (254) on Free Info Card

DIGITAL FIBER-OPTIC SYSTEM

Artel MegaLink 1360: the latest addition to the MegaLink family, the MegaLink 1360 transports serial digital component video at the D-1 tape format speed of 270Mb/s, 360Mb/s full-bandwidth standard-definition television (SDTV) or Mezzanine level HDTV; it is available in three basic configurations — transmitter, receiver or transceiver; applications include studio-to-transmitter links, transmitter-to-studio links, interfacility interconnections, and metropolitan switched digital video networks; 508-303-8200; 508-303-8197; www.artel.com

Circle (255) on Free Info Card

ASPECT RATIO CONVERTER

Axon Digital Design ARC2000: the product line of two-way aspect ratio converters is designed for conversion from 4:3 to 16:9 and back, including pan scan, letterbox and pillarbox; high-quality vertical filtering is reached by using a temporal (3 fields) 12 lines FIR filter; inputs and outputs are SDI, 10-bit serial digital video (270Mb); 888-919-9379 or 212-265-6865; fax 212-265-6402; www.axon.nl; ncocny@mindspring.com

Circle (256) on Free Info Card

MPEG-2 VIDEO CODEC SYSTEM

Barco Communications Systems RE 4220: a highly integrated and compact MPEG-2 video codec system, that has the capability to encode and deliver a DTV-compliant datastream to a DTV transmitter or satellite uplink, which can be used for SDTV video distribution; the RE 4220 offers a migration path from SDTV to HDTV; 216-871-7617; fax 216-871-4303

Circle (257) on Free Info Card

A-TO-D CONVERTER SYSTEM

Benchmark Media Systems ADA2008: a bidirectional four-channel, 20-bit converter system that is ideal for VTRs and routing switchers; it has four channels of analog-to-digital conversion, four channels of digital-to-analog conversion, an internal power supply and a 1RU chassis; 800-262-4675 or 315-437-6300; www.benchmarkmedia.com

Circle (259) on Free Info Card

CABLES FOR HDTV BROADCAST APPLICATIONS

Belden 7731A digital video coax: intended for internal studio use, this RG-11/U-type coaxial cable meets the SMPTE 292M standard for bit-serial digital interface for HDTV systems; this high-performance cable is designed to support cable runs up to 500 feet, making it ideal for the long-haul infrastructure, between room and interfacility, in broadcasting studios and post -production facilities; 800-BELDEN-4 or 847-818-1880; fax 847-818-1886

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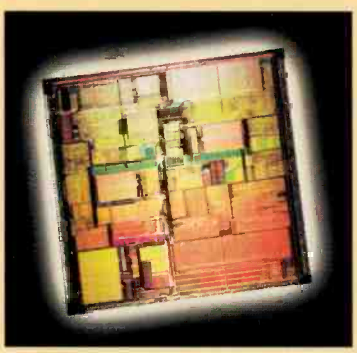

MPEG ENCODING PRODUCTS

C-Cube DVxpert single-chip MPEG-2 encoder family: the DVxpert 5110 is a single-chip MPEG-2 Main Level @ Main Profile broadcast encoder; it provides special features designed to optimize multichannel broadcast applications, while maintaining the highest image quality for the viewer; the DVxpert 6210 is a professional encoder that can compress images into MPEG-2 Main-Level @ 4:2:2 or MPEG-2 Main Level @ Main Profile; it handles 4:2:2 video streams from 5 to 60Mb/s; 408-490-6300; fax 408-944-6314; www.c-cube.com

Circle (260) on Free Info Card

DIGITAL VIDEO JACKS

Canare DVJ series: this series of digital video jacks is designed to handle the patching requirements of DTV/HDTV facilities; they offer 1.4GHz bandwidth performance with extremely low VSWR; incorporating unique sealed microswitch contacts to lock out dirt, dust and humidity, the jacks are available in normal-through and straight-through models; the DVJs are true 75Ω; 818-365-2446; fax 818-365-0479; www.canare.com

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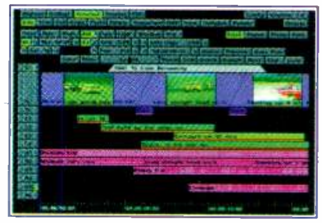
Collage

The little grey box that ~~could~~ Does!

Combining character generation, paint, still store and animation,
Collage offers a wider range of graphics tools than any other on-air graphics device.

Still Store

"4:4:4:4 image quality, fast image capture and recall, TCP/IP based networking, and a diverse range of transition effects."



Editing

"Affordable timeline based non-linear editing with uncompressed video clips, features 4 layers of DVE, 8 layers of 24 bit audio and all the graphics tools that made Collage famous."

Character Generator

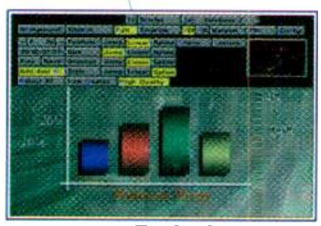
"A user friendly C.G. that renders postscript and true type fonts with multiple surface, edge and shadow styles. Collage features numerous real-time text animations and works with newsroom computer systems."

3D Animation

"Quickly create three dimensional graphics with true 3D bevels, extrudes, multiple light types, texture and bump mapping."

Paint System

"Full featured painting tools including variable size and contoured brushes, custom brushes, texture and opacity mapping, and VTR control for frame capture or rotoscoping."



2D Animation

"Flexible keyframe animation of object attributes makes Collage 2D a powerful tool for creating complex layered graphic treatments."

With over 550 systems in use worldwide the Collage family offers proven performance at surprisingly affordable prices. There is a Collage solution to almost every broadcast or post-production problem.

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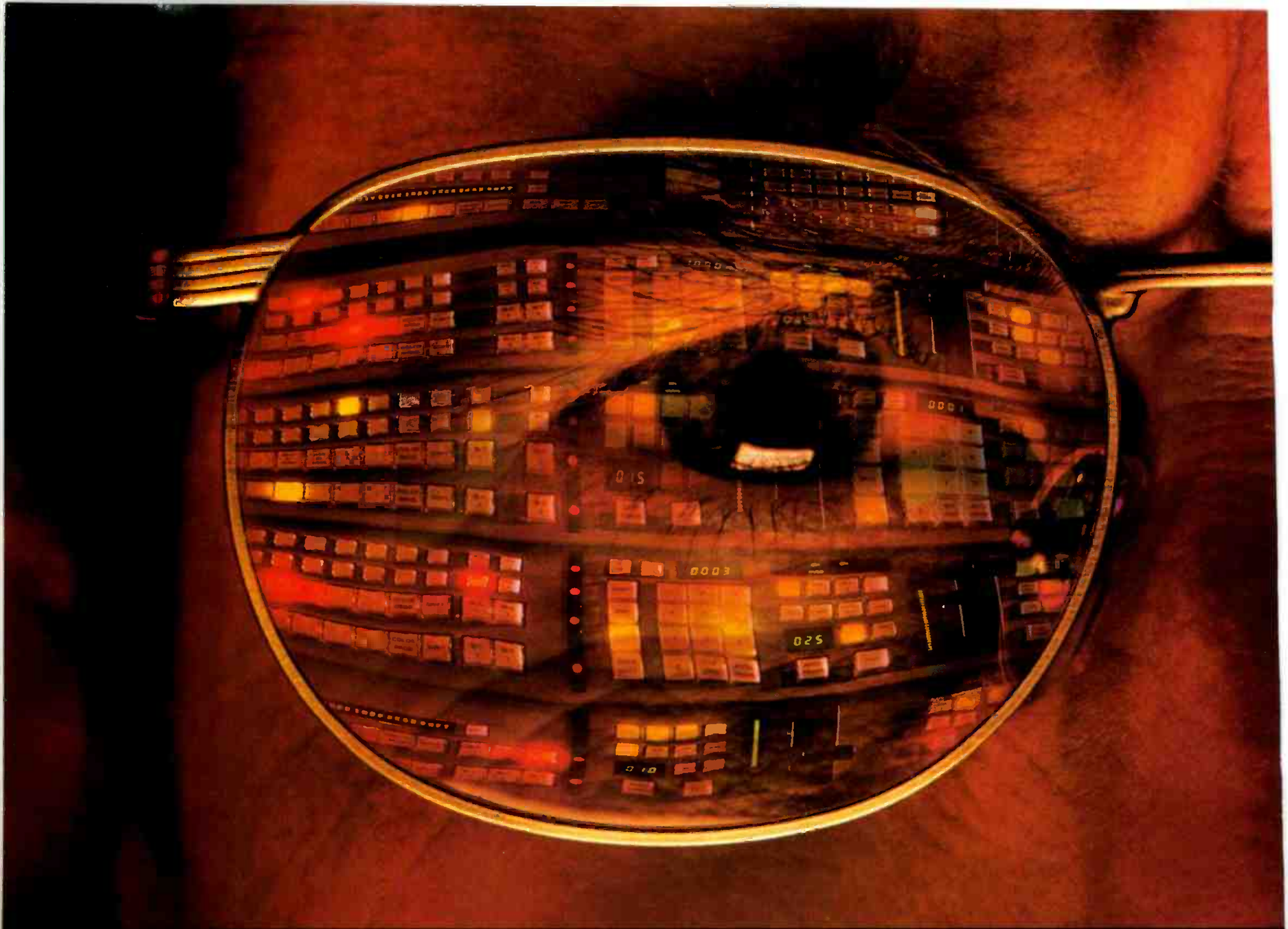

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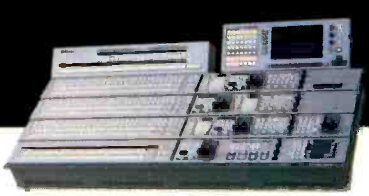

DVS-7350 System

DVS-7250 System

HDTV LENSES

Canon HDTV lenses: a full line of ENG and studio-style HDTV lenses including the HJ15X8B IRS/IAS standard zoom lens, the HJ18X7.8B IRS/IAS long zoom lens, the HJ 9X5.5B IRS/IAS wide-angle zoom lens, the UJ20X7B HDTV studio lens and the UJ65X9.5B HDTV field zoom lens; all of the lenses incorporate Canon's Internal Focus (IF) technology for superior optics; 800-321-4388; fax 201-816-9702; bctv@cusa.canon.com; www.usa.canon.com

Circle (262) on Free Info Card

HDTV ANALYSIS

Central Tower HDTV analysis: Central Tower is offering HDTV analysis and tower inspections on your existing structures to determine HDTV readiness, in addition to full-service site planning, manufacturing and installation; 800-664-8222 or 812-853-0595; fax 812-853-6652; www.centraltower.com

Circle (263) on Free Info Card

HDTV TRANSMISSION OVER COAX

CommScope 7538: with a 0.159-inch diameter, this miniature, low-loss digital coax cable provides outstanding performance in digital applications including HDTV; the small size allows improved wiring management in high-density areas; for longer runs, CommScope has the 5765 low-loss serial digital cable; 704-459-5000; www.commscope.com

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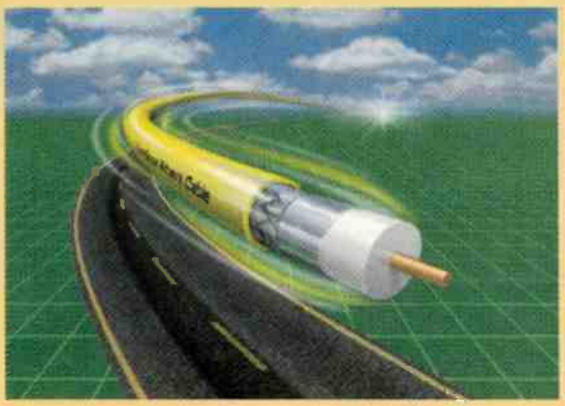

TELECINE SYSTEM

Cintel C-Reality: C-Reality offers uncompromised 14-bit digital scanning resolution in each of three color channels — a full 1,920 pixels per line and a full 1,080 lines of color resolution; full bandwidth scanning enables transfers at HD, 525, 625 and 2K RGB; 805-294-2310; fax 805-294-1019

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DIGITAL SATELLITE NEWSGATHERING FLYAWAY PACKAGE

Continental Microwave/RF Technology DSNG technology: field-proven digital satellite newsgathering technology with Flyaway packages; available with 1m, 1.5m and 2.2m antennas; single thread or redundant; at C, X, Ku and K band (or any combination), and feature a wide range of digital video and compressed analog video options; 203-866-4283; fax 203-853-3513

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DIGITAL VIDEO ROUTING SWITCHERS

Datatek D-2800 high density series: a high-density series of digital video routing switchers for medium-to-large systems, and for all standards to 360Mb/s; the series features a 128x128 digital video matrix in 11 rack units, 192x192 in 22 rack units and 256x256 in 44 rack units; this high-density series uses the same control system as the D-2800 series of digital and analog video and audio routers; 800-882-9100 or 908-654-8100; fax 908-232-6381

Circle (267) on Free Info Card

TRANSPORT STREAM GENERATOR

Digital Transport Systems MPEG-2/DVB transport stream generator system: new configurations provide greater flexibility, PCI bus-based architecture and WindowsNT functionality; this system allows equipment designers and manufacturers to perform real-time capture and playback of MPEG-2/DVB transport streams for use as a test source for multiplexers, demodulators or encoders; 619-675-1410; fax 619-675-1412; sales@dtsys.com

Circle (268) on Free Info Card

EXPANDED DTV FEATURES FOR PRONTOVISION

Digital Video Systems ProntoVision: new enhancements (some are special - order options) provide for concurrent storage of virtually all interlaced and progressive HDTV and SDTV formats in a single system; if has the ability to switch from HDTV to a multichannel SDTV server, record/play of the Panasonic HD360 compressed stream format and a frame doubler playout option that allows any material recorded in progressive 30 format to be played out in progressive 60 or interlaced 60 formats; 818-846-9444; fax 818-846-7444; info@digitalvideosystems.com; www.digitalvideosystems.com

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HIGH-DEFINITION ADVANCED SCRATCH CONCEALER II

Digital Vision HDASC-II: an enhanced product based upon Digital Vision's five years of experience with the original ASC; the HDASC-II now provides area isolation to help reduce or completely eliminate random film scratches and film dirt without generating undesirable artifacts using a real-time electronic process; 310-914-5200

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PROGRAM ENCODER

DiviCom MediaView MV40: this encoder is based on C-Cubes' MPEG-2DVx platform and delivers increased channel count and improved video quality; the MV40's design harnesses the power of two complete compression/decompression silicon engines to analyze and encode program data, then perform a more refined yet similar operation again using data from the first operation; it can also maintain picture quality at extremely low bit rates, offering TV service providers more flexibility in allocating program bandwidth; switchable 4:2:0 and 4:2:2 formats, and DVB and ATSC compliance; 408-944-6700; fax 408-944-6705; www.divi.com

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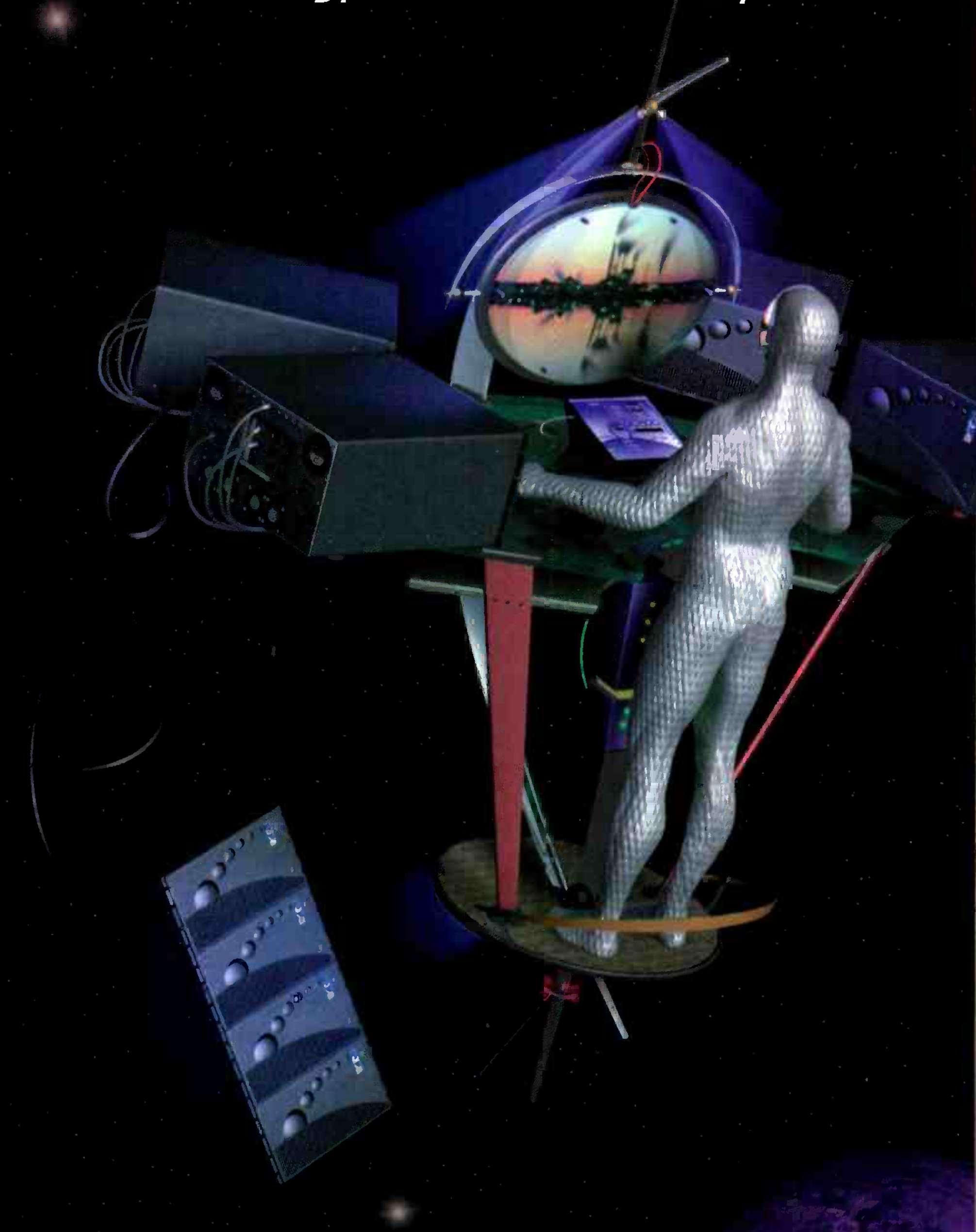

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ENCODERS

Dolby Laboratories Dolby Digital encoders: the DP561B multi-channel encoder and the DP567 two-channel encoder both feature Dolby Digital (AC-3), the standard audio format for ATSC digital for television; Dolby's range of Dolby Surround units will enable digital broadcasting to get under way with two-channel Dolby Digital audio matrix-encoded for surround-sound playback on home systems equipped with Dolby Pro Logic decoding; 415-558-0200; fax 415-863-1373; info@dolby.com; www.dolby.com

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SWITCHER

ECHOlab 5900: a large digital video switcher with an integrated server running Microsoft Windows NT; the new 4:2:2 component digital switcher has a full-function layout with two M/Es in addition to a program/preset bank, six keyers and up to 33 inputs and 18 outputs; the ECHOlab 5900 runs ITU-R 601 component digital, in 10-bit quality and is HDTV ready; the modular back panel provides total flexibility between digital I/O and 10-bit quality I/O; all inputs can be configured in any combination of formats; 781-273-1512; fax 781-273-3275; www.echolab.com

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HIGH-PERFORMANCE VIDEO MODULATOR AND DEMODULATOR

EFData Corporation (a division of California Microwave) SDM-2020: a high-performance video modulator and demodulator designed specifically for high-speed satellite transmission; ideal applications include DVB, DSNG, primary and backhaul transmission for contribution, distribution and HDTV; it operates in one-bit steps from 1Mb/s to 100Mb/s; 602-968-0447; fax 602-921-9012; www.efdata.com/index.html

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STRUCTURAL ENGINEERING AND TOWER REINFORCING SERVICES

ERI/Electronics Research Inc.: structural and tower reinforcing services to help meet the demands that are placed on existing tower structures with the arrival of DTV; the team consists of structural, civil, mechanical and electrical engineers; 812-925-6000; 812-925-4030; www.ERIinc.com

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AUDIO MIXING SYSTEM WITH DTV CAPABILITY

Euphonix CS3000: this audio mixing system with DTV capability has 5.1 Discrete Surround Sound capabilities, now specifically available for broadcasters; this feature has been well-tested and proven, and is popular in Euphonix's installed film and post markets customer base; 415-855-0400; fax 415-855-0410; www.euphonix.com

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HIGH-DEFINITION REAL-TIME GRAPHICS SYSTEM FOR ON-AIR USE

Evolving Video Technologies AnteroHD: a high-definition on-air graphics system that combines all the features of the Antero Ascent character generator system with the HDTV formats that broadcasters require; all graphics created on AnterO2 and Antero Ascent are upward compatible with the AnteroHD system, providing a single system and operation interface for the design of graphics for SDTV and HDTV; 303-465-1556; fax 303-465-2012

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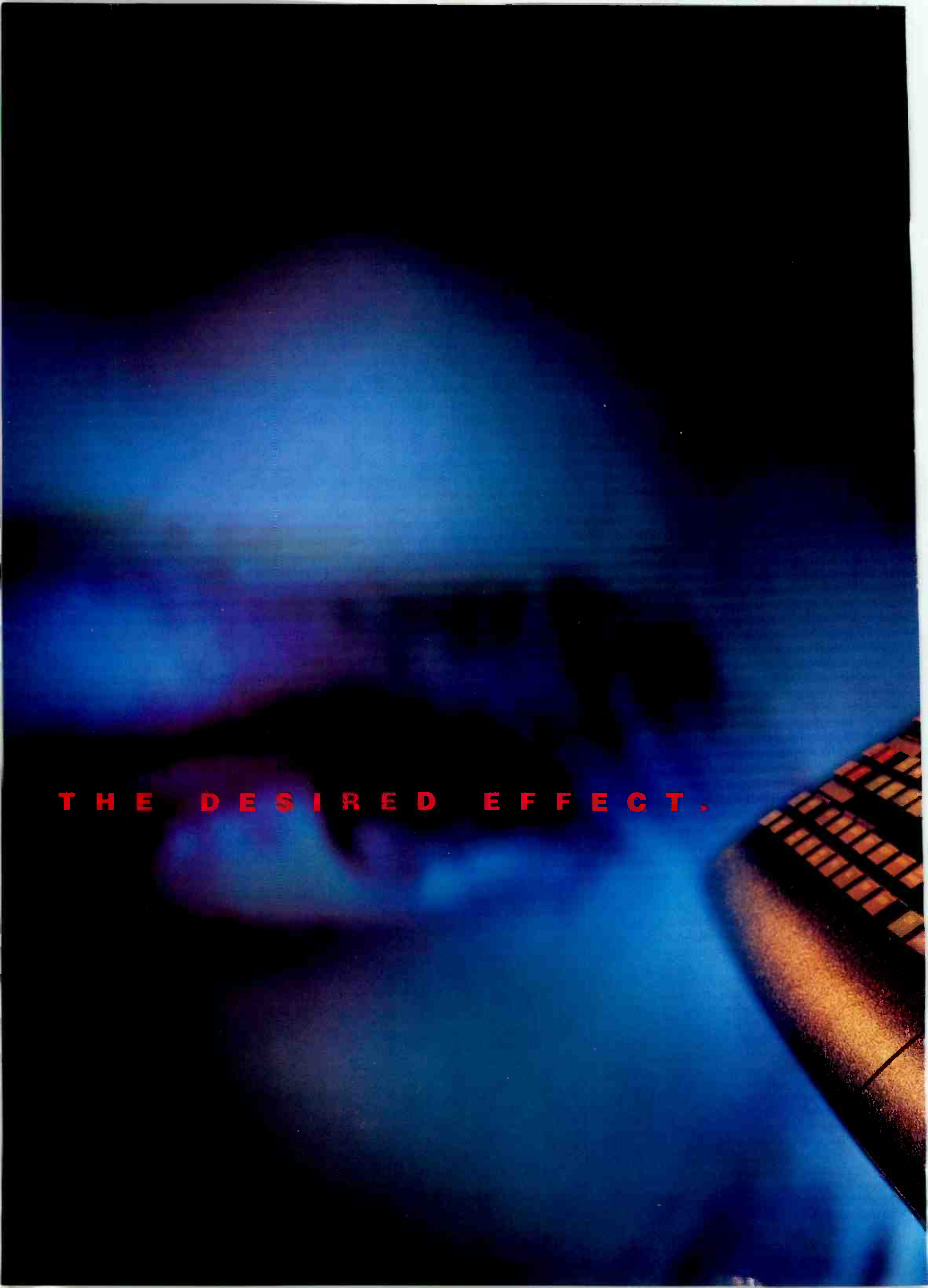
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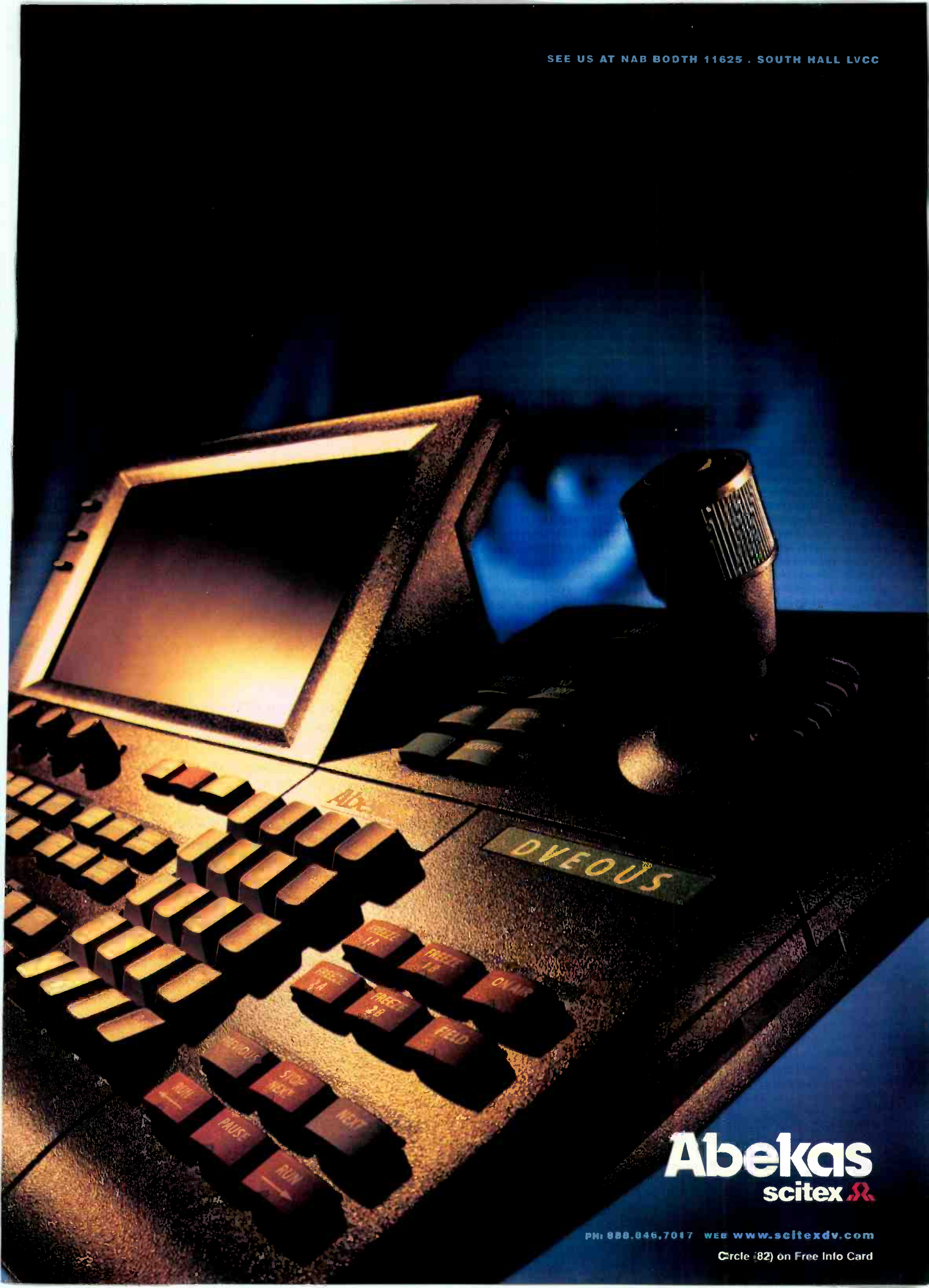

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ASPECT RATIO CONVERTER WITH AUDIO PROCESSING

Eyeheight SQ-1000: this new aspect ratio converter for digital television has been designed with inherent flexibility to convert to and from any of six different aspect ratios — 16:9, 15:9 and 14:9 letterbox formats, 4:3 full frame format as well as 2.35 and 1.85 anamorphic formats; the SQ-1000 features a "flexible zoom" mode that can compress and expand horizontally and vertically; +44 1784 423838; fax +44 81 641 0985; eyeheight@easynet.co.uk; www.eyeheight.com

Circle (278) on Free Info Card

HDTV LENSES

Fujinon HDTV lenses: this series includes several portable lenses such as the HA10X5.2BEVM, the HA14X8EVM and the HA20X7.5BEVM; other lenses in the series include the HA24X7BESM studio lens and the HA66X9.5ESM field lens; all the lenses in this series of high-definition lenses have features to satisfy the excellent picture quality of HDTV; 800-553-6611; 201-633-5600; fax 201-533-5216

Circle (279) on Free Info Card

DIGITAL TAPE DEGAUSSER WITH EMF SHIELDING

Garner Industries Eliminator 4000FS: this Eliminator 4000 digital tape degausser is available with electromagnetic (EMF) shielding that reduces radiated EMFs by more than 50%; it is simple to operate and allows bulk degausser users to greatly reduce their exposure to EMFs without compromising tape erasing quality or productivity; degaussing is well-suited for digital formats such as DVCPRO, DVCAM and DIGITAL S; 402-434-9100; fax 402-434-9133; www.garnerindustries.com

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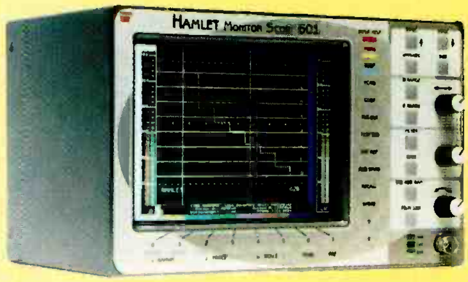


MONITOR SCOPE

Hamlet Monitor Scope 601: this device provides analysis of NSTC and PAL serial digital 601, AES/EBU and all analog signals, with data displays, waveforms, vectors, colored bar graphs and peak-level indicators on its own built-in, high-quality color LCD; the digitized in-picture video outputs can also be transmitted and seen on any other monitor; this product will be exhibited at the James Grunder and Associates booth; +44 (0) 1494 793 763; fax +44 (0) 1494 791 283; steve@hamlet.co.uk

Circle (282) on Free Info Card

ATSC DIGITAL TV ENCODING SYSTEM

Harris Flexicoder: an MPEG-2 ATSC multichannel/multiformat encoding system that gives broadcasters an economical migration path to DTV; based on a modular and card-upgradeable platform, Flexicoder lets broadcasters invest in a single-channel standard-definition or high-definition system and then upgrade to a redundant multichannel system; it can be configured for board-level and system-level redundancy; the system supports all ATSC scan formats, and output conforms to the new SMPTE 310M interface standard; 513-459-3400; fax 513-459-3890; hbd@harris.com. www.broadcast.harris.com

Circle (283) on Free Info Card

ATSC 8-VSB DIGITAL TV EXCITER

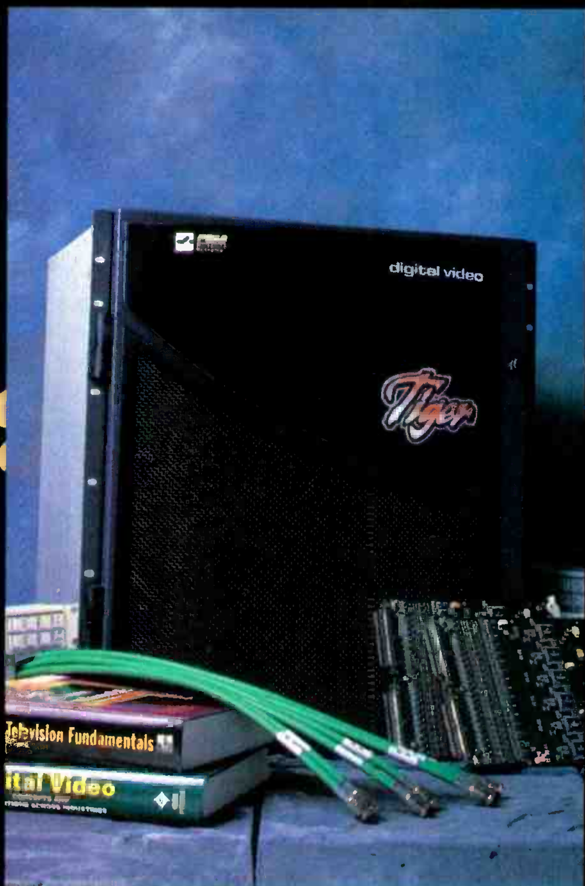
Harris CD 1A: a second-generation 8-VSB exciter for DTV (ATSC) broadcasting; the CD 1A combines the field-proven design of the industry standard CD1 with a welcome array of useful product enhancements such as a standard SMPTE 310M interface and a new mechanical package for better accessibility; it also features options such as extended software-based monitoring/diagnostics and adaptive transmitter equalization; 513-459-3400; fax 513-459-3890; hbd@harris.com. www.broadcast.harris.com

Circle (284) on Free Info Card

Tiger

144 x 144 Routing Switcher

Introducing the largest scaleable routing switcher...with the smallest footprint.



- A Digital/Analog Routing Switcher scaleable from 8 x 16 to 144 x 144. Low cost expansion to 288 x 288, or beyond.
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- Two outputs/bus with equalization.
- WIN3500 System Controller with Tieline Management supports a wide selection of control panels. Single or dual controllers can be installed inside the video chassis.

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DIGITAL SOLID-STATE UHF TRANSMITTER

Harris DiamondCD: developed exclusively for digital television, this digital solid-state UHF transmitter includes many features to maximize coverage, performance and reliability; the highly distributed, redundant architecture includes "smart" PA modules with built-in protection, control and diagnostics; one switching power supply is provided for every two PA modules; 513-459-3400; fax 513-459-3890; hbd@harris.com. www.broadcast.harris.com

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MULTISTANDARD STUDIO/ FIELD CAMERA

Hitachi SK-3000 & SK-3000P (portable version): a multistandard studio camera that provides simultaneous HDTV and NTSC outputs; features include a seven-inch viewfinder and automatic 16:9/4:3 signal conversion; the 1.5Gb/s digital output from the camera head is brought to the camera control unit via an optical fiber cable; in addition to the standard analog and digital HDTV outputs, the signal is digitally converted to an NTSC rate (16:9 or 4:3) for the serial digital component and analog outputs; this camera uses 2,000,000-pixel CCDs and operates in a 16:9 HDTV format at all times; 516-921-7200; fax 516-496-3718

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HDTV FULL DIGITAL CAMERA

Ikegami HDK-790: a top-of-the-line full digital HDTV studio camera for broadcast use, featuring three $^{2}/_{3}$-inch CCD image sensors each with 2,000,000 pixels; with a downconverter built into its CCU, the HDK-790 supports not only traditional NTSC broadcasting, but also HDTV; it also incorporates newly developed digital processing ICs to implement all-digital image processing and the camera achieves full-digital HDTV implementation, boasting a wide variety of digital specific features and functions; 201-368-9171; fax 201-569-1626

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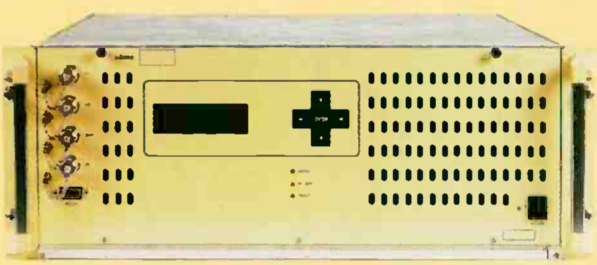

8VSB MODULATOR/EXCITER

Itelco DTV (8VSB) modulator/exciter: this product features excellent performance fully compliant to 8VSB ATSC DTV standard and upconverter to VHF B.III or UHF B.IV.V; it has a modular plug-in design with compact dimensions; +39 763 316231; +39 763- 316239

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DIGITAL UHF EXCITER MODULATOR

ITS DT20: this UHF exciter modulator is a state-of-the-art DTV product that uses an ATSC-compliant 8VSB modulator; when coupled with ITS' Class A solid-state amplifiers, the DT20 is a high-quality, cost-effective method to transform an existing klystron transmitter into a split analog/DTV transmitter; various configurations are available to suit many existing UHF transmitters; 412-941-1500; fax 412-941-4603

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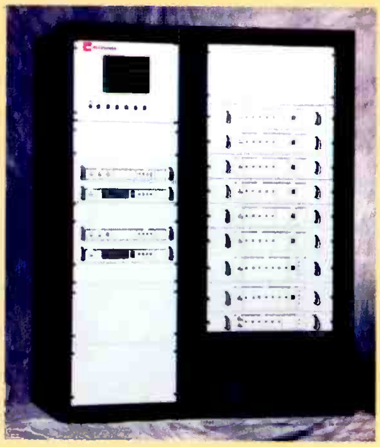

UHF SOLID-STATE DTV TRANSMITTERS

ITS 8800 Series: these transmitters achieve superior digital transmission at average power levels up to 5kW; they can be easily upgraded with the addition of an IOT final amplifier and use identical class AB power amplifiers to provide redundancy; 412-941-1500; fax 412-941-4603

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HIGH-POWER TRAVELING WAVE UHF SLOT ANTENNA

Jampro JTW traveling wave antenna: this antenna is available in various patterns and polarizations for effective broadcast coverage to achieve maximum market penetration; highly null-filled vertical patterns, high-power handling, high gains and single feed point assure optimum pattern performance and low VSWR; now available for DTV applications; 916-383-1177; fax 916-383-1182

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WIDESCREEN DIGITAL CAMERA

JVC KY-D29W: this digital camera is switchable from its native 16:9 aspect ratio to traditional 4:3, offering the ultimate flexibility in image capture to broadcasters and high-end producers; the KY-D29W achieves widescreen capacity via three 460,000-pixel 16:9 CCDs and boasts a microlens over each pixel for maximum sensitivity and negligible vertical smear; the camera can dock to any format, uses 14-bit digital signal processing and three-dimensional digital noise reduction (3D DNR); it features an S/N ratio of 65dB, 850 lines of horizontal resolution; 800-JVC-5825 or 201-794-3900; fax 201-523-2077; www.jvcpro.com

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DIGITAL-S TAPE

JVC DS-124: this robust 1/2-inch metal particle cassette offers two hours of 4:2:2 component Digital-S recording time and works in all JVC Digital-S camcorders, dockable field recorders and studio VTRs; running 124 minutes in length, other tapes in the Digital-S line include the DS-104, the DS-64, the DS-34 and the DS-10; 800-JVC-5825 or 201-794-3900; fax 201-523-2077; www.jvcpro.com

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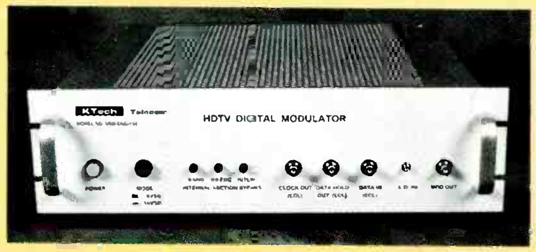

8-VSB MODULATOR

KTech 8-VSB modulator: this product is designed for HDTV terrestrial broadcast systems and conforms to ATSC specifications and features all solid-state construction for high reliablity; it also has IF or RF output options and accepts MPEG-2 source input; another feature is the clock lock indicator and the phase locks clock to the MPEG-2 source; 818-361-2248; fax 818-270-2010; www.ktechtelecom.com; skuh@ktechtelecom.com

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HDTV DIGITAL SIGNAL GENERATOR

Leader Instruments LT 440D: a test signal generator that operates in the 1125/59.94 HDTV system and complies with BTA S-004A, S-005A, S-006A and SMPTE 229M, 291M and 292M; it incorporates serial digital outputs of standard and dedicated test signals that include the pathological check field including embedded four-channel AES/EBU audio test tones; a dedicated digital audio output feed is also provided; 800-645-5104 or 516-231-6900; fax 516-231-5295

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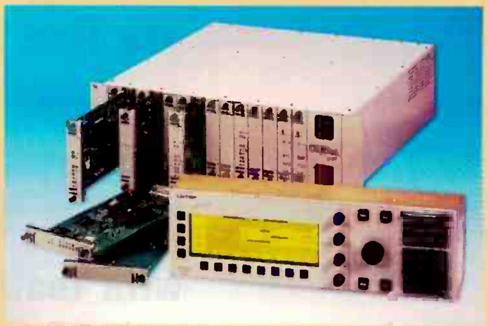

HDTV EQUIPMENT

Leitch HDTV Glue family: HDTV Glue family includes several products based on Leitch's DigiBus platform — the HD frame synchronizer for reclocking, serial in and out, gen-lock (locks to NTSC blackburst) and no jitter — the HD test generator features built-in line-based, frame-based and static test signals — the HD logo generator with serial or component output, external logo creation and data interface — the HD serial DA featuring three outputs, serial 1.5Gb/s input and 1.5Gb/s output, as well as reclocking and no jitter — HD conversion products for component analog to 1.5Gb/s HDTV and vice versa; other products in the HDTV Glue family include the HD upconverter, the HD video router and the HD master control switcher; 800-231-9673; fax 757-548-4088; www.leitch.com

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SERIAL DIGITAL DECODER

Leitch DES-6801: a decoder that transforms noisy satellite signals into useful, synchronized, 4:2:2 signals; it has a hot switch feature that allows it to hold the last frame of good video during a switch; other features include analog gen-lock, a full frame synchronizer, full bandwidth VITS handling capability and infinitely variable H & V phasing; the DES-6801 and the DEC-6801(without frame sync) are currently available for the 6800 and 7000 series of digital frames; 800-231-9673; fax 757-548-4088; www.leitch.com

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ABSORPTIVE FILTERS

Micro Communications Inc. (MCI) UHF dual-mode absorptive filters: these filters can be used on the output of high-power common amplification DTV transmitters to provide a constant impedance VSWR as seen by the transmitter; they also attenuate and absorb out-of-band splatter generated by the transmitter that could affect NTSC reception on an adjacent channel; 603-624-4351; fax 603-624-4822; www.mcibroadcast.com

Circle (305) on Free Info Card

SERIAL DIGITAL VIDEO DISTRIBUTION AND FIBER-OPTIC PRODUCTS

Multidyne DTV-200 series: a product line intended to ease the engineering and financial difficulties associated with the migration to DTV; the series provides a solution for the coaxial and fiber-optic transport and distribution of virtually any digital signal from 50Mb/s to 650Mb/s; the supported standards include SMPTE 259M serial digital interfaces, 4:2:2 component and widescreen, 540Mb/s 4:4:4:4 Sonet/SDH and ATM; 800-488-8378 or 516-671-7278; fax 516-671-3362; info@multidyne.com; www.multidyne.com

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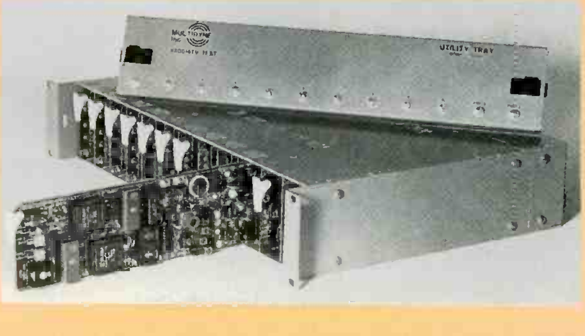

SERIAL DIGITAL VIDEO ROUTER

Network Electronics VD 3232 Xpro: a 32x32 serial digital video router with vertical interval switching; this state-of-the-art router provides maximum quality with a data rate of up to 540Mb/s, with automatic cable equalizing on all inputs; a built-in RS-232 interface allows control of the router via Network Electronics 32-CrossSoft PC software with many operational features; +47 334 63200; fax +47 334 63201

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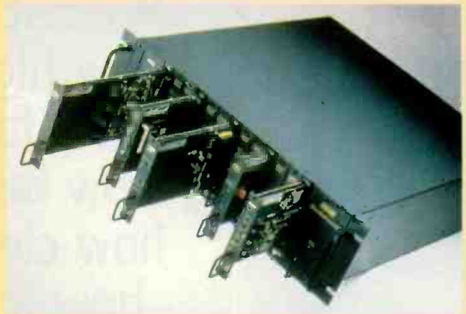

SIGNAL PROCESSING PRODUCTS

Nova Systems/ Videonics new modules for StudioFrame: the modular and flexible StudioFrame system accommodates today's, as well as tomorrow's, video and audio interfacing requirements; the DTV-ready and scaleable nature of its 10-bit architecture, along with wide, comprehensive product range, allows it to be easily reconfigured and/or upgraded as video standards and requirements continue to evolve; 860-693-0238; fax 860-693-1497

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HIGH-DEFINITION STUDIO CAMERA

Panasonic AK-HC850: featuring three 2/3-inch 2,000,000-pixel M-FIT CCD imagers, this high-definition studio camera delivers the full high-definition bandwidth of 1,000 TV lines of resolution; it uses serial digital fiber-optic cable link to transfer RGB 4:4:4 data at 2.2Gb/s from the camera head to the CCU and the unit also has parallel 1,125-line HD and 525 interlace outputs; 201-392-6176; fax 201-392-6558; www.panasonic.com/pbds

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HIGH-DEFINITION PORTABLE CAMERA

Panasonic AK-HC800: the AK-HC800 is a portable companion to the AK-HC850 high-definition studio camera; featuring three 2/3-inch 2,000,000-pixel M-FIT CCD imagers, this high-definition camera delivers the full high-definition bandwidth of 1,000 TV lines of resolution and uses serial digital fiber-optic cable link to transfer RGB 4:4:4 data at 2.2 Gb/s from the camera head to the CCU; the unit also has parallel 1125-line HD and 525 interlace outputs; 201-392-6176; fax 201-392-6558; www.panasonic.com/pbds

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HIGH-DEFINITION VIDEO SWITCHER

Panasonic AV-HS1200: a 10-input, compact production switcher suitable for edit and post-production facilities requiring a 1,125-line interface scan high-definition production capability with built-in digital video effects; it provides excellent picture quality, 10-bit digital video with 14-bit processing and digital filtering for high-quality keying; the unit's two mix-effects generators, with large fluorescent display for each M/E make operation simple; M/E functions include MIX, NAM, WIPE, KEY and DVE; the M/E can mix three video sources; 201-392-6176; fax 201-392-6558; www.panasonic.com/pbds

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ROUTING SWITCHER

PESA Tiger routing switcher: this routing switcher is scaleable from 8x16 to 144x144; the video chassis (12RU) supports SMPTE 259M digital and 60MHz analog video in the same frame and the audio chassis (8RU) provides two channels of analog audio or two AES levels; the Tiger is expandable to 288x288 or larger; 516-845-5020; fax 516-845-5023; salesinfo@pesa.com; www.pesa.com

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DIGITAL NOISE REDUCERS

Philips PreCast VsdB Series: the PreCast multichannel noise reduction system greatly improves MPEG compression efficiency; the multichannel noise reduction for digital broadcast applications features a 20% to 30% gain in MPEG encoding efficiency; other features include patented motion adaptive, spatial and temporal filtering, as well as FM sparkle, dirt and scratch concealment; 801-977-1611; fax 801-972-0837; info@mail.phbtsus.com; www.philipsbts.com

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HIGH-RESOLUTION DIGITAL CAMCORDER

Philips LDK 150 DVCPRO 50Mb camcorder: a high-resolution digital camcorder featuring unique digital audio processing, 4:2:2; recording, 24-bit internal processing and more than 30 minutes of record time; 801-977-1611; fax 801-972-0837; info@mail.phbtsus.com; www.philipsbts.com

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HDTV VIDEO ROUTING SWITCHER

Philips Venus HDTV switcher: a 16x16 video routing switcher for moving 1.5Gb HDTV signals throughout the broadcast facility; it integrates with the Jupiter control system; 801-977-1611; fax 801-972-0837; info@mail.phbtsus.com; www.philipsbts.com

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REAL-TIME DIGITAL SPECIAL EFFECTS SYSTEM

Pinnacle Systems DVEXtreme: a real-time digital special effects system for high-end broadcast and post-production applications; the video fidelity is pristine given its 10-bit 4:2:2 processing and advanced filtering techniques; the DVEXtreme can be configured for dual- or triple-channel operation and each channel comes with video and key standard; 650-526-1600; fax 650-526-1601; pr@pinnaclesys.com; www.pinnaclesys.com

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VIDEO IMAGE STORAGE SYSTEM

Pinnacle Systems Lightning 1000 Family: this top-of-the-line image management product offers one-, two- or three-channel operation; standard storage capacity is 6,500 stills, with internal expansion capability beyond 10,000 stills; 650-526-1600; fax 650-526-1601; pr@pinnaclesys.com; www.pinnaclesys.com

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HIGH-DEFINTION DIGITAL VIDEO RECORDER

Pluto Technologies HyperSPACE: a flexible high-definition, disk-based solution for recording interlaced or progressive and more than three hours of high-definition or more than four hours of standard definition; HyperSPACE conforms to all SMPTE standards; it can be configured for eight bits making it signal compatible with products such as the Panasonic D-5 videotape recorder working at 360Mb/s; 303-402-9000; fax 303-541-9343; www.plutotech.com

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FIXED MICROWAVE LINK

RF Technology ACL series: this series is a fixed microwave link offered in turnkey digital STL packages with a number of different system configurations available; options include single- and multichannel of NTSC and/or ATSC video with a number of modulation schemes, including 16QAM; transmission rates up to and greater than DS3 (45Mb/s) are available; 203-866-4283; fax 203-853-3513

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DIGITAL PRODUCTION SWITCHERS

Ross Video Synergy series: a family of digital production switchers designed for live news, live sports and live production; over-the-shoulder boxes, picture freezes, repositioning of keys, pushes and more are available with the innovative "squeeze & tease" feature; other features include preview overlay, 12 aux buses, up to 64 inputs, VTR control, external DVE integration and redundant power; 613-652-4886; fax 613-652-4425; www.rossvideo.com; solutions@rossvideo.com

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DTV-READY MPEG-2 DIGITAL VIDEO COMPRESSION SYSTEM

Scientific-Atlanta PowerVu with DTV capabilities: the PowerVu MPEG-2 digital video compression system has been expanded with the addition of the PowerVu HD encoder and decoder; the new PowerVu products will allow the system to deliver multiple SDTV or HDTV in an ATSC format to provide a variety of application solutions from MPEG 4:2:2 or 4:2:0 profiles; 404-903-5000; fax 404-903-4617; www.sciatl.com

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REPEATABLE SOURCE FOR ATSC TEST SIGNALS

Sencore AT951 ATSC stream player: an affordable answer for digital video facilities looking for a reliable ATSC signal source for repeatable test signals for use in repair, manufacturing or testing environments of ATSC products; ATSC transport streams can be recorded and played out at data rates of up to 60Mb/s; 800-SENCORE or 605-339-0100; fax 605-339-0317

Circle (322) on Free Info Card

DIGITAL AUDIO ROUTING SWITCHER

Sierra Automated Systems and Engineering SAS 16000 D: a digital audio routing switcher for stations that require up to a 32x32 digital audio matrix; a unique monitor allows the user to listen to the AES/EBU or S/PDIF digital audio input signals; the SAS 16000 D is compatible with the complete range of SAS remote-control panels; 818-840-6749; sales@sasaudio.com

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VIDEO DISK RECORDING SYSTEM

Sierra Design Labs HD 1.5Plus: a video disk recording system that allows users to record in standard 601 or uncompressed DTV/HDTV video; using four of Sierra's Quickframe video disk recorders with a new Sierra-designed HD processor, users can record uncompressed HDTV video, SMPTE 274M/292M 1920x1080 interlaced signals, with the ability to switch to SMPTE 296M 1280x720 progressive scan video; the HD 1.5Plus is available in HD capacities starting in 10-minute increments; 702-831-7837; fax 702-831-5710; www.sdlabs.com

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ALL-DIGITAL HDTV UPCONVERTER

Snell & Wilcox HD5050: a powerful studio-quality HDTV production tool that represents the third generation of HDTV upconversion products for Snell & Wilcox; the HD5050 accepts 10-bit serial digital standard-definition inputs and delivers full studio-quality 1.5Gb/s true HD serial digital outputs with fully specified 74.25MHz sampling clock rate resulting in the equivalent of 30MHz analog bandwidth; it features a fully specified digital HDTV synchronizer and high-quality aspect ratio conversion; +44 181 607 9455; fax +44 181 607 9466; www.snellwilcox.com; info@snellwilcox.com

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NEW GENERATION HD ROUTING SWITCHER

Snell & Wilcox HD1132: a 32x32 serial digital HDTV router that can operate as a stand-alone routing system or as the front-end of the HD1024 24-input production switcher; the compact, 4RU HD1132 uses standard industry control protocol making it easy to fit into existing studio control environments; +44 181 607 9455; fax +44 181 607 9466; www.snellwilcox.com; info@snellwilcox.com

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COMPACT HIGH-DEFINITION DOWNCONVERTER

Snell & Wilcox HD 200: a compact and cost-effective HDTV downconverter; typically for dual-format studio applications and other requirements where high-definition material needs to be combined with standard-definition programming material economically; also particularly suited for studio monitoring applications in conjunction with HDTV cameras and VTRs; +44 181 607 9455; fax +44 181 607 9466; www.snellwilcox.com; info@snellwilcox.com

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HDTV PRODUCTION SWITCHERS

Snell & Wilcox HD1012 & HD1024: powerful 12- and 24-inputs HDTV production switchers; featuring 1.5Gb/s true HD serial digital operation, both switchers offer three keyers (two on the ME and one DSK), program output, preset output, border generators, three chroma-keyers, two wipe generators with 100 wipes each, timeline control and seven RGB color correctors; a key feature of both switchers is the ability to add an integrated DVE system through an optional upgrade; +44 181 607 9455; fax +44 181 607 9466; www.snellwilcox.com; info@snellwilcox.com

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EDITING RECORDER/ PLAYER FOR BETACAM SX

Sony DNW-A75: the latest recorder/player in the Betacam SX product line, the DNW-A75 editing recorder/player features frame-accurate editing on Betacam SX tape, plus a full range of BetacamSP playback capabilities; the DNW-A75 also adds efficiency to editing by recognizing shot information entered during acquisition; 800- 686-SONY; fax 201-358-4058; www.sony.com

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MPEG ENCODER

Snell & Wilcox MPE1000: a discrete hardware-based high-quality MPEG encoder that uses Phase Correlation Motion Estimation (Ph.C) technology to deliver the extremely accurate vector information resulting in a high-quality output — ordinarily about 20% better than existing MPEG encoders at given bit rates; due to the high quality and uniformity of the Ph.C motion vectors, the MPE1000 will not exhibit MPEG blocking artifacts when the signal degrades; +44 181 607 9455; fax +44 181 607 9466; www.snellwilcox.com; info@snellwilcox.com

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DV-BASED NON-LINEAR EDITING SYSTEM

Sony ES-3: a DV-based non-linear editing system is the first professional-level editing system with direct i.LINK (IEEE-1394) interface support for DV and DVCAM acquired digital footage; it features ClipLink support and Direct Digital Link for i.LINK, QSDI and SDI digital interfaces in addition to standard analog I/Os; 800- 686-SONY; fax 201-358-4058; www.sony.com

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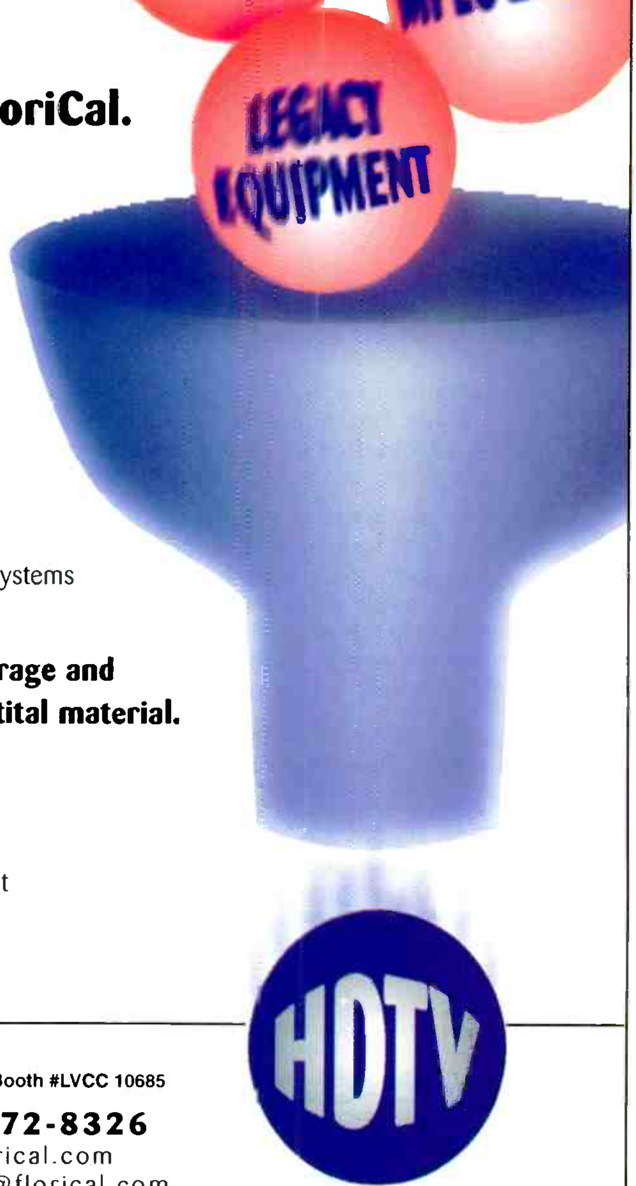

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HIGH-DEFINITION CAMERA

Sony HDC-700: a full-featured studio/OB camera that uses Sony's 2,000,000-pixel Hyper HAD frame interline transfer (FIT) CCD imagers; it is designed to bridge the transition from 525-line NTSC to an all-digital HDTV/SDTV combination; the HDC-700 uses the same standard $^2/_3$-inch lens interface as the present 525-line SDTV camera family (BVP700/750/500/550 series), allowing convenient lens interchange as part of a cost-effective migration path; 800-686-SONY; fax 201-358-4058; www.sony.com

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HIGH-DEFINITION CAMERA

Sony HDC-750: a portable companion to the HDC-700, the HDC-750 is a full-featured studio/OB camera that uses Sony's 2,000,000-pixel Hyper HAD frame-interline transfer (FIT) CCD imagers; it is also designed to bridge the transition from 525-line NTSC to an all-digital HDTV/SDTV combination; the HDC-750 uses the same standard $^2/_3$-inch lens interface as the present 525-line SDTV camera family (BVP700/750/500/550 series), allowing convenient lens interchange as part of a cost-effective migration path; 800-686-SONY; fax 201-358-4058; www.sony.com

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COMPARE

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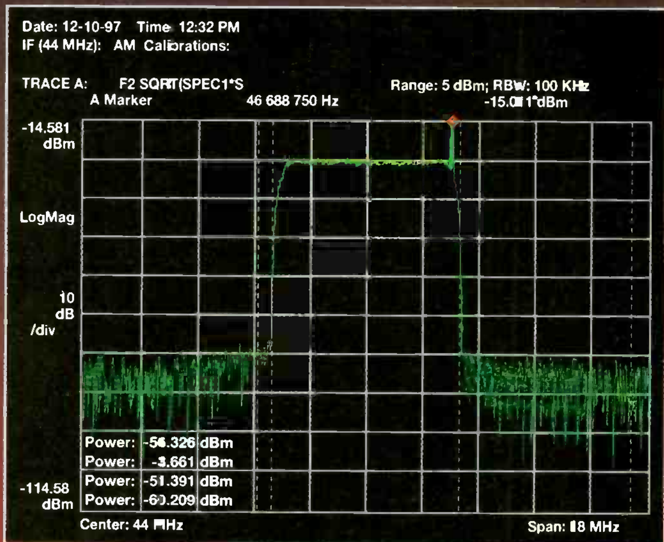

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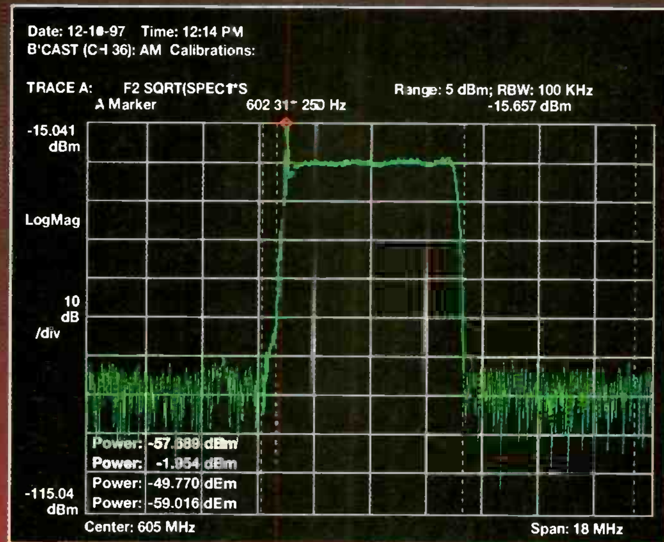
52 dB down at the band edges.



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We always knew that the Diacrode® and Advanced Tetrode were *good!* We just didn't know *how* good. The answer to the out-of-band problem is obvious. Just look at the wave forms. It's too late to ask for an ACRODYNE transmitter after you've interfered with your neighbor.

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Circle (85) on Free Info Card

SERIAL DIGITAL STILL-STORE

Spencer Technologies serial digital SS-2000: a serial digital version of the SS-2000 still-store; designed specifically for live news production, the unit can be configured as a dual standard, serial digital and composite video system; the dual standard I/O also includes a linear key output per channel and up to three channels are available; it also features a powerful database and up to 10,000 still storage capacity; 818-840-0907; fax 818-840-8375; www.Spencer-Tech.com

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RANGE OF HDTV UPCONVERTERS

Tekniche Juno: an advanced range of high-quality upconverters developed with 16-bit internal accuracy to facilitate the transition from SDTV to HDTV; standard features include analog and digital outputs, full 10-bit resolution with 16-bit internal processing, flexible architecture with options for conversion to 1920x1080, 601 and 1280x720, 60P and 640x480, 60P formats; 201-784-2288; fax 201-784-3860; www.tekniche.com; 106307.1121@compuserve.com

Circle (339) on Free Info Card

DSP-BASED ENCODER FOR BTSC STEREO SIGNALS

Standard Communications SSG2000BD: by processing the audio signals in the digital domain, this DSP-based encoder for BTSC stereo signals produces BTSC signals of exceptional quality, with significant improvements in stereo separation, SNR and frequency response over comparable analog systems; other features include high/low selectable audio input impedance, optional SAP, and optional AGC circuitry; 310-532-5300; fax 310-515-7197

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FULLY DIGITAL HDTV WAVEFORM MONITOR

Tektronix WFM1125: a digital TV waveform monitor used to monitor the baseband digital TV signal as it passes among HDTV cameras, recorders and special effects, routing and transmission equipment; the WFM1125 monitors baseband SMPTE 292M or BTA-S004A 1.485 Gb/s serial-component-data video in the SMPTE 274M 1920x1080 interlace format; 800-426-2200 (press 3, code 1058); fax 413-448-8002; www.tek.com/Measurement

Circle (340) on Free Info Card

PARALLEL-TO-SERIAL CONVERTER

Tektronix PSC1125: a parallel-to-serial converter for generating HDTV 1.5Gb/s SDI signals; it is intended for use with the Tektronix TSG1001 HDTV test signal generator; the PSC1125 accepts a parallel digital input from the SG1001 and outputs a 1.5Gb/s SDI datastream that conforms to SMPTE 292M and 274M standards providing a relatively low-cost solution for generating HDTV SDI signals; 800-426-2200 (press 3, code 1058); fax 413-448-8002; www.tek.com/Measurement

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MPEG/DVB TEST GENERATORS AND ANALYZERS

Tektronix MTS200 Series: MPEG test systems that offer extensive MPEG and DVB analysis capabilities to perform functions ranging from real-time analysis to custom creation and in-depth analysis of MPEG transport streams; they perform real-time analysis with trigger capability for trapping errors that can be analyzed in detail at a later time; 800-426-2200 (press 3, code 1072); fax 413-448-8002; www.tek.com/Measurement

Circle (342) on Free Info Card

The Electronic Patch Bay

Introducing the MAV 128 RCA Matrix Switcher

Extron's **MAV 128 RCA** is an audio/video matrix switcher with RCA connectors for audio and BNC connectors for video. This 12 x 8 matrix is a simple solution for routing multiple inputs to multiple outputs in an editing suite environment. As an electronic patch bay, the MAV 128 RCA makes it easy to track inputs to outputs and re-configure a system as needed.

The MAV 128 RCA features a front panel with touch button control for quick configuration. It also provides RS-232/422 with Extron's Simple Instruction Set™ for easy set-up of a control system. The MAV 128 RCA may even be operated via a remote PC with Extron's Windows® based control program software.

High performance features of the MAV 128 RCA include:

- 12 inputs x 8 outputs
- RS-232/422 control with Simple Instruction Set™
- Front panel, touch button control
- Windows® based control program software
- RCA connectors for audio
- BNC connectors for video
- Audio gain/attenuation level adjustments made at front panel, input by input
- 80 MHz (-3 dB) video bandwidth
- Audio gain settings: -9 dBu to +15 dBu per input

Extron's MAV 128 RCA lists for $3070. The MAV 84 RCA, an 8 x 4 configuration which lists for $1995, is also available.

Come see Extron at NAB '98 in Booth #M7219

Extron Electronics

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DIGITAL TRANSMISSION

Telecast Fiber Systems Digital Viper: the Viper fiber-optic system now provides digital transmission for outside broadcasting applications; it simultaneously carries analog, video, serial digital video, audio, intercom and control data over a single, lightweight fiber-optic cable; the system uses plug-in modules to mix and match multiple analog (NTSC or PAL) video signals with ITU-R 601 serial digital video streams; 508-754-4858; fax 508-752-1520; www.telecast-fiber.com; fiberac@telecast.fiber.com

Circle (343) on Free Info Card

DIGITAL CAMERA

Thomson Broadcast Systems 1707: a single-piece digital triax camera designed for intensive use in all kinds of studio and outside broadcast applications from acquisition to transmission over triaxial cable; it features advanced levels of integration, making it easier and lighter to handle; +33 1 3420 7000; fax +33 1 3420 7047; www.thomsonbroad.com; sales@thomsonbroad.com

Circle (344) on Free Info Card

DIGITAL STUDIO CAMERA

Thomson Broadcast Systems 1557D: this cameras is available in several configurations to provide optimum performance and flexibility to meet the most exacting requirements; in addition, the 1557D uses boards that are interchangeable with the 1657D, for simpler and cost-effective maintenance; +33 1 3420 7000; fax +33 1 3420 7047; www.thomsonbroad.com; sales@thomsonbroad.com

Circle (345) on Free Info Card

STUDIO SERVER

Thomson Broadcast Systems Nextstore: a two- or four-channel server developed in close collaboration with Digital Equipment Corporation; it is designed for the majority of operating configurations and is equally suited to production or post-production or use as a cache for transmission; +33 1 3420 7000; fax +33 1 3420 7047; www.thomsonbroad.com; sales@thomsonbroad.com

Circle (346) on Free Info Card


GSC3000 I/O 16
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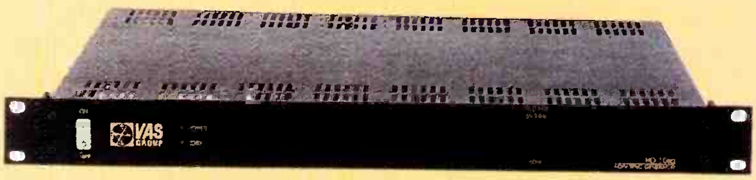
DIGITAL SET-TOP BOXES

TV/COM TVC-3000 series: this series of Hyundai digital set-top boxes provides a low-cost decoding platform for digital video, audio and data services; MPEG-2 and DVB compliant, it also includes virtual channels, teletextsubtitling/closed-captioning, subscriber messaging, software downloadabilty and a full set of diagnostics; an electronic program guide (EPG) is included, as well as standard industry parental control, and favorite channel and clock features; 619-618-350-0; fax 619-618-3550

Circle (350) on Free Info Card

HDTV TRI-LEVEL SYNC GENERATOR



VAS Group HD-10sg: this HDTV tri-level sync generator has the ability to lock its tri-level HDTV sync to 525 house sync to ensure that both HD and SD systems are in phase; this unique feature is useful when downconverting HD material to standard-definition video; the locking capability also facilitates synchronizing digital audio between HD and NTSC systems; 818-843-4831; fax 818-843-6544; www.vasgroup.com; info@vasgroup.com

Circle (351) on Free Info Card

MULTIFORMAT ONSCREEN MONITOR FAMILY

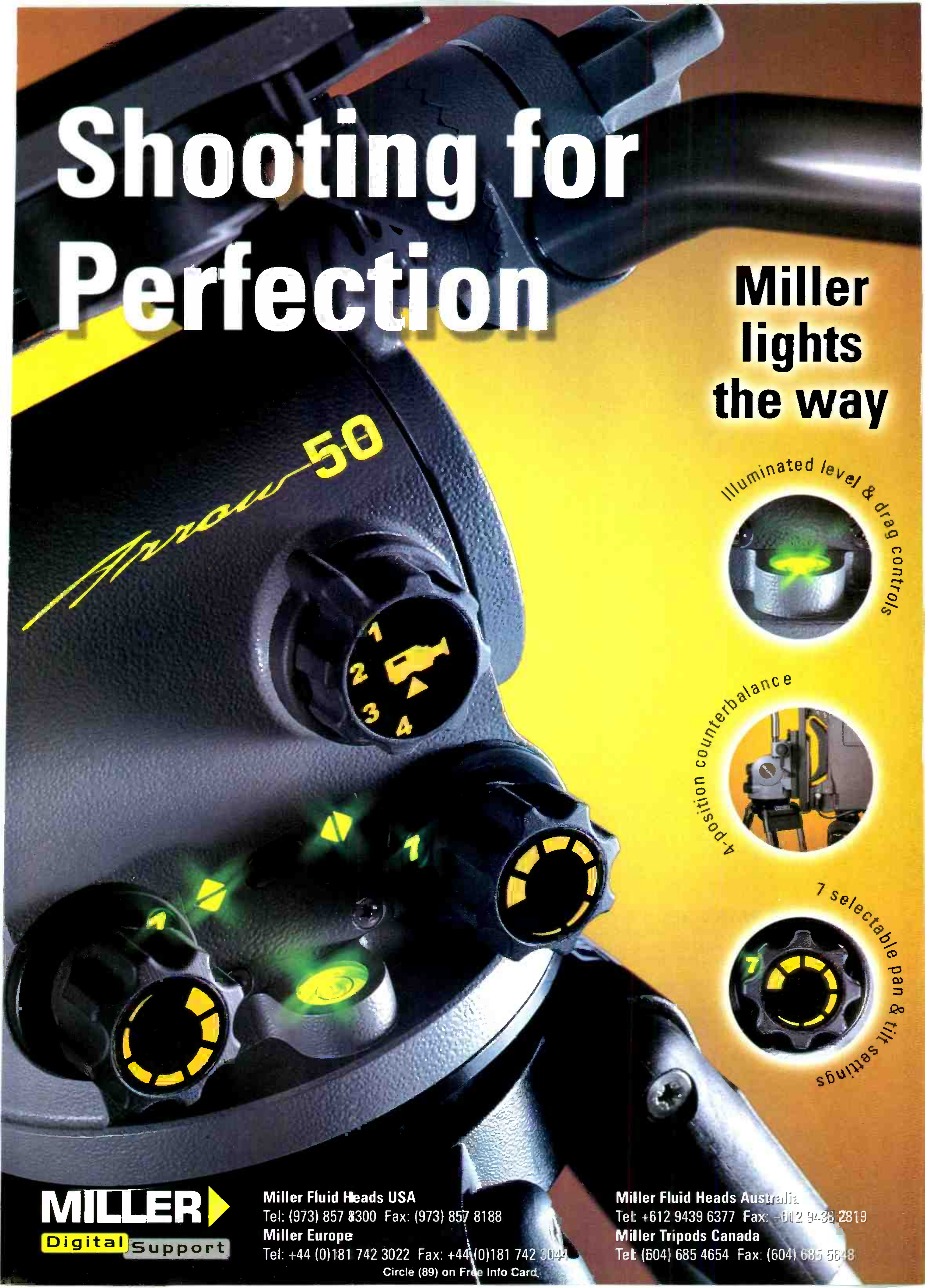
Videotek VTM-200: this family of products provides a revolutionary means in which to monitor and measure 601 and AES digital and composite analog (NTSC and PAL) video and audio signals for less than half the cost of traditional methods; the primary output is SVGA compatible for display on any standard computer monitor; 610-327-2292; fax 610-327-9295; www.videotek.com; sales@videotek

Circle (352) on Free Info Card

VIDEO ANALYSIS, EDITING AND PREVIEW SYSTEM

Viewgraphics Viewstore 6000: a RAM-based, resolution-independent video analysis, editing and preview system; it supports all video formats including the 16 ATSC formats, eight channels of digital audio and frame-accurate editing; 650-903-4900; fax 650-969-6388; www.viewgraphics.com; nab98@viewgraphics.com

Circle (353) on Free Info Card



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Tel: (604) 685 4654 Fax: (604) 685 5648
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MODULAR SIGNAL PRE-PROCESSING SYSTEM

Vistek Valet: a modular signal pre-processing system with modules that currently cover analog composite video (PAL/NTSC/PAL-M/PAL-N) clean decoding, high-quality conversion of analog component video to digital, clean decoding of composite digital (D-2) to component digital, conversion of analog audio into digital with adjustable delay, digital audio/video multiplexing, digital video noise removal, digital video "brickwall" filtering, digital signal processing and synchronization; +44 (0) 1628 531221; +44 (0) 1628 531221; fax +44 (0) 1628 530980; www.vistek.co.uk; 100270.3601@compuserve.com

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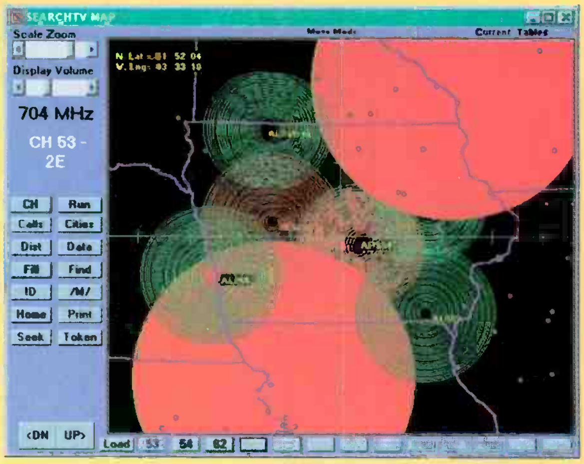

PROGRAM FOR SEARCHING BROADCAST TV BAND FOR NEW OR UPGRADE CHANNELS

V-Soft Communications SEARCHTV: this program uses the FCC's rules to search the broadcast TV band for new or upgrade channels; the program combines standard analog, DTV and LPTV stations studies into one package; two fully interactive maps screens are skillfully integrated allowing the user to move to a new search location with a mouse click; a complete FCC database of TV and LPTV stations and DTV assignments is provided; 319-266-8402; fax 319-266-9212; www.V-Soft.com

Circle (356) on Free Info Card

DIGITAL AUDIO DISTRIBUTION AMPLIFIER

Ward-Beck D8201: this eight-output DA is frame-compatible with the Ward-Beck 8200 series analog audio products and features cable equalization, data reclocking, transformer balanced inputs and outputs and a convenient monitoring jack; 800-771-2556 or 416-438-6550; fax 416-438-3865;www.wbsltd.com; wbsltd@istar.ca

Circle (357) on Free Info Card


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SNEAK PEEKS

Here is the most comprehensive, pre-show list of new products and technology to be exhibited at NAB. These companies have released in advance to *Broadcast Engineering* magazine information on these new products. For most of these products, this is their first public showing.

To make your selection of the hundreds of products contained here as efficient as possible, we've arranged them by category. Pick your category, find the products, hit the floor. What could be easier? If you'd like more information about the products to be mailed to you, use the Reader Service card on p. 325.

Avoid the crowds and see these companies and products first to get your own private demonstration. Then, while others are lost in the crowds, you'll be sipping a cool one knowing you've already seen the hottest technology at this year's show.

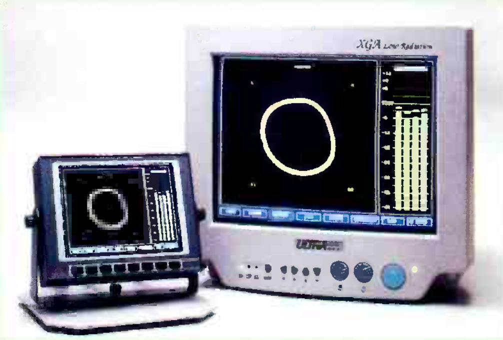
SNEAK PEEKS

AUDIO ACCESSORIES

AES/EBU DIGITAL AUDIO ADAPTERS

Neutrik NADITBNC-F and NADITBNC-M: these adapters feature digital audio impedance transformer adapters and allow for longer cable runs via unbalanced coaxial lines rather than twisted-pair cables; criteria include impedance matching between 100Ω and 75Ω, transition of balanced/unbalanced circuit (balun), optional electrical isolation, optional attenuation for use of analog video distribution equipment and reduction of hum and noise; 732-901-9488; fax 732-901-9608; www.neutrikusa.com

Circle (362) on Free Info Card



FOUR-CHANNEL MASTER STEREO DISPLAY

DK-Audio MSD600C/MKII: this upgrade has been redesigned to fit an improved VGA color display; the color LCD display offers a brighter image with double backlights and a contrast ratio improved by 100%; new features include the ability to drive an external monitor and a surround-sound option that allows users to monitor the surround-sound information on the screen; because a pseudo-surround-sound decoder is built in, an external decoder is not needed; other features are analog and digital (AES/EBU) operation, phase meter, audio vector oscilloscope and level meter with seven different scales and optional FFT spectrum analysis; 45-44-53-02-55; fax 45-44-53-03-67; DK-Audio@dk-audio.dk; www.dk-audio.dk

Circle (363) on Free Info Card

AUDIO MIXERS — STUDIO, RECORDING

DIGITAL CONSOLE

Solid State Logic Aysis Air: this 48-channel digital console incorporates its own router for stand-alone operations but can be extended to use SSL's hub router to provide access to more than 2,000 sources and destinations; the system offers reduced wiring complexity with 95 channels of digital audio on a single coaxial cable; a dedicated control surface is optimized for real-time mixing operations, and all console controls are fully automated via snapshots; all settings can be stored and instantly recalled selectively or globally; 212-315-1111; fax 212-315-0251; www.solid-state-logic.com

Circle (364) on Free Info Card

DIGITAL PRODUCTION CONSOLES

Soundtracs DPC-II, Virtua version 2.0: the DPC-II totally digital system consists of a modular work surface and dedicated racks for analog/digital conversion; work surface frames provide 16 to 96 100mm moving fader control; all sizes support 160 channels and up to 224 audio interfaces; each block of 16 channels can have its own touch-sensitive LCD color display; the stand-alone Virtua 48-channel mixer features four-band fully parametric EQ, compressors and gates on every channel, eight auxiliaries and 24 tape outputs; 16 return inputs are configured as eight stereos with level, balance, mute and master output only; 48 full inputs comprise 32 analog mic/lines and 16 digital inputs; the 32 analog inputs are individual remotely switchable between mic and line connectors; 516-333-9100; fax 516-333-9108

Circle (365) on Free Info Card

DIGITAL MIXING CONSOLE

AMEK DMS: designed for audio post-production and broadcast applications; provides fully all-digital mixing with 32-bit floating-point DSPs and modular I/O system supported by a highly flexible chassis design; 818-973-1618; fax 818-973-1622; amek@pacificnet.net; www.amek.com

Circle (366) on Free Info Card

AUDIO RECORDING, STORAGE AND PLAYBACK

MULTITRACK PLAYER

Tascam MMP-16: a multiformat, cross-platform, digital audio playback system designed to work seamlessly with most digital audio workstations; as a 16-channel hard-disk-based digital audio player, it employs 20-bit D/A conversion with 24-bit AES digital output, direct Pro Tools Session file playback and direct WaveFrame playback compatibility; it also features support for OMF/Sound Designer II file playback and includes an internally mounted removable hard drive (using the Kingston Drive Carrier supplied with the unit) with SCSI support; 213-726-0303; fax 213-727-7635; www.teac.com

Circle (367) on Free Info Card

MINI DISK RECORDER

Otari MR-30: a professional, convenient and cost-effective digital recorder that uses commercially available MiniDiscs; it provides various recording, editing and playback functions for broadcast, post-production and sound reinforcement; features include 148 track minutes per MiniDisc, AES/EBU and SPDIF inputs, basic editing with multiple layers of undo and instant playback of selected tracks; 650-341-5900; fax 650-341-7200

Circle (368) on Free Info Card

SNEAK PEEKS

ISDN CODEC/RECORDER/ EDITOR

NAGRA C-PP: this unit is universally powered from 94VAC to 264VAC, 48Hz to 63Hz mains; the C-PP can be used for recording, playing and virtual editing of digital audio files using PC card FLASH memory technology as the storage media; the codec communicates using the MPEG (Layer II), G.722 and G.711 compression systems via international ISDN protocols, US National 1 and EURO-ISDN; the unit can be programmed to automatically receive and record files on removable FLASH memory PC cards and play pre-selected files each time a call is received; replacing the RJ45 telephone connection with a SMPTE/EBU time-code connector transforms the C-PP into a TV/cinema post-production playback unit; 615-726-5191; 800-813-1663; fax 615-726-5189; mail@nagra.com

Circle (369) on Free Info Card

EQ SOLUTION FOR DIRECTX

TC Electronic TC Native EQ Works with SoftSat: TC Works, TC Electronic's new signal processing plug-in company, has a new full line of TC-quality plug-ins available for host-based DSP equalization supporting DirectX and Cubase VST on Windows 95/NT PCs; the TC Native EQ Works package includes two plug-ins — TC Native EQ-P and TC Native EQ-G; Native EQ Works supplies all the equalization tools necessary for audio production or mastering on a DirectX compatible or Cubase VST PC digital audio recording system; 805-373-1828; fax 805-379-7578; www.tcelectronic.com; tcus@tcelectronic.com

Circle (371) on Free Info Card

SNEAK PEEKS

HARD DISK RECORDER

360 Systems DigiCart/II Plus digital recorder: combines the work of three machines — hard-disk recorder, mini audio workstation and digital cart machine; recordings stored on two internal hard disks and a removable zip drive; system provides eight, 16 or 24 hours of AC-2 recording time, maximum recording time of 144 hours; 818-991-0360; fax 818-991-1360; info@360systems.com; www.360systems.com

Circle (370) on Free Info Card

AUTOMATION SYSTEMS - TV, NEWSROOM AND MASTER CONTROL

MASTER CONTROL AUTOMATION SYSTEM

FloriCal Systems AirBoss-NT: this system operates on the Windows NT platform and provides seamless integration between traffic and master control; the system is designed for one-person operation and can be expanded to control an unlimited number of channels; 352-372-8326

Circle (372) on Free Info Card

INTEGRATED MANAGEMENT SYSTEM

Columbine JDS Paradigm: the revolutionary integrated management system first launched for national networks and DBS multichannel operations is now available for broadcast TV operations; the system electronically links all critical business processes of a TV station, including ad sales, programming, traffic, finance and master control automation, into a single relational database improving efficiency and providing greater control; 303-237-4000; fax 303-237-8485; www.cjds.com; info@cjds.com

Circle (373) on Free Info Card

CAMERA SYSTEM

NS MICROWAVE newsroom camera system: this system controls up to 10 cameras from a single location; presets can be saved and internal camera functions and accessory equipment are controlled by touchscreen or mouse with the company's software; cameras can be located in the building or off-site, with dedicated or dial-up lines used for control; an ergonomic sensitive control station with a hand-grip joystick with thumb toggle positions the various functions of the pedestal and camera/lens combination; 619-670-0572; fax 619-670-7040

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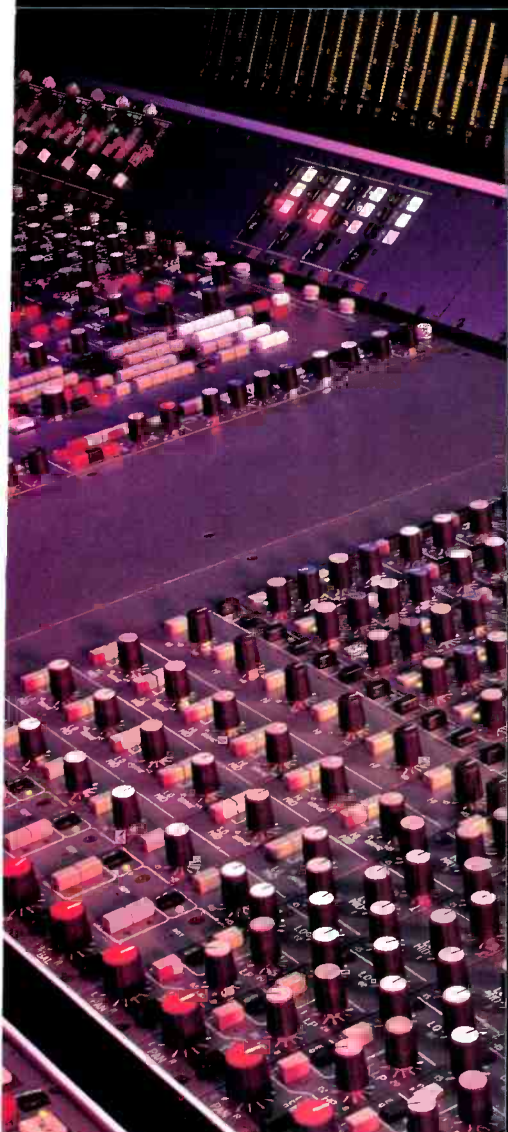

VIDEOCART

AAVS DIVA DVCPRO: with a modular design, this videocart allows a fully customized configuration, based on standard modules with one or more expansion modules; several videocart machines can be linked together via a remote-control network; DIVA DVCPRO can be used in a wide variety of applications, under the control of AAVS's Acube automation system or other automation systems; it holds up to three VTRs with a capacity of 160 cassettes; +33 1 49 88 34 34; fax +33 1 48 57 33 58; contact@aavs.fr

Circle (377) on Free Info Card

AUTOMATION CONTROLLER

Matco MA-204B: the latest update to the MA204 series, this product is a highly reliable, free-standing automation controller and 22x3 video and stereo audio router; the MA-204B adds SMPTE and tone cuing as standard, Microsoft Windows-compatible control program and direct support of video servers, including the Matco MA-400; 408-353-2670; fax 408-353-8781; matco1@ix.netcom.com

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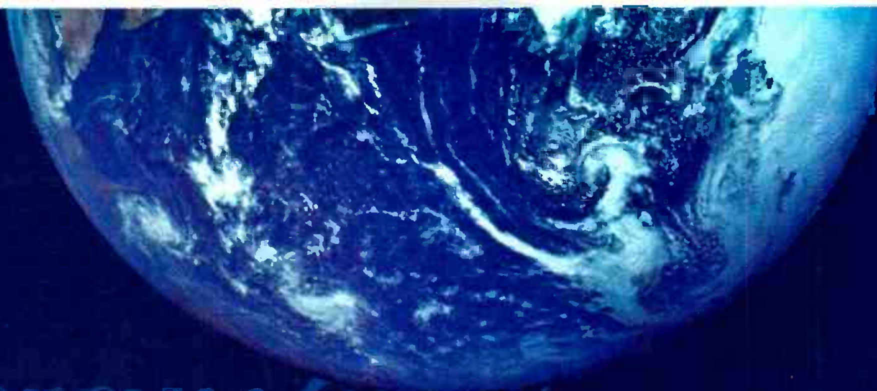

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See us at NAB Booth #S4357

SNEAK PEEKS

CABLE TV EQUIPMENT & SET-TOP BOXES

COMMERCIAL INSERTION SYSTEM

SeaChange International Broadcast MediaCluster: this unit performs multichannel origination, commercial playback and time shift/delay; features MPEG-2, ML/4:2:2 profiles, a PC-based server platform, Windows NT-based operation and SeaChange's RAID-2 server cluster architecture; 978-897-0100; fax 978-897-0132; www.schange.com

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COMMERCIAL INSERTION MODULE

Videomedia VIP-PL play list module: V-LAN compatible; creates sequences by dragging clips from one or more bins that are extracted from a master database onto a time line; sequences can be created, recalled and edited when other sequences are playing; WIN95/NT interface and picture icons make system easy to use; 408-227-9977; fax 408-227-6707; www.videomedia.com

Circle (379) on Free Info Card

CAMERA SUPPORT & ROBOTICS, VIRTUAL SETS

ROBOTIC RAIL TRACK

Radamec robotic rail track system: provides broadcast-quality movement for on-air camera shots; supports Radamec 421 and 435S pan and tilt heads; easy to operate; configurable with any Radamec control panels; +44 (0) 1932 561181; fax +44 (0) 1932 568836; radamec_broadcast@lineone.net

Circle (382) on Free Info Card

SOFTWARE LOADER

Orad Cyberset M: this product allows the import of Softimage models and animations for use in conjunction with the CyberSet virtual studio; time line animations can be generated and controlled at object level; other features include shape animation (3-D morphing), the display of a sequence of images anywhere within the virtual set, camera animation that allows the animator to create fly-throughs without moving the camera and memory-space-saving instantiation, which allows the creation of an object to be replicated; 44-(0)171-799-3100; fax 44-(0)171-976-0922; 100665.2767@compuserve.com

Circle (383) on Free Info Card

TURNKEY VIRTUAL STUDIO SYSTEMS

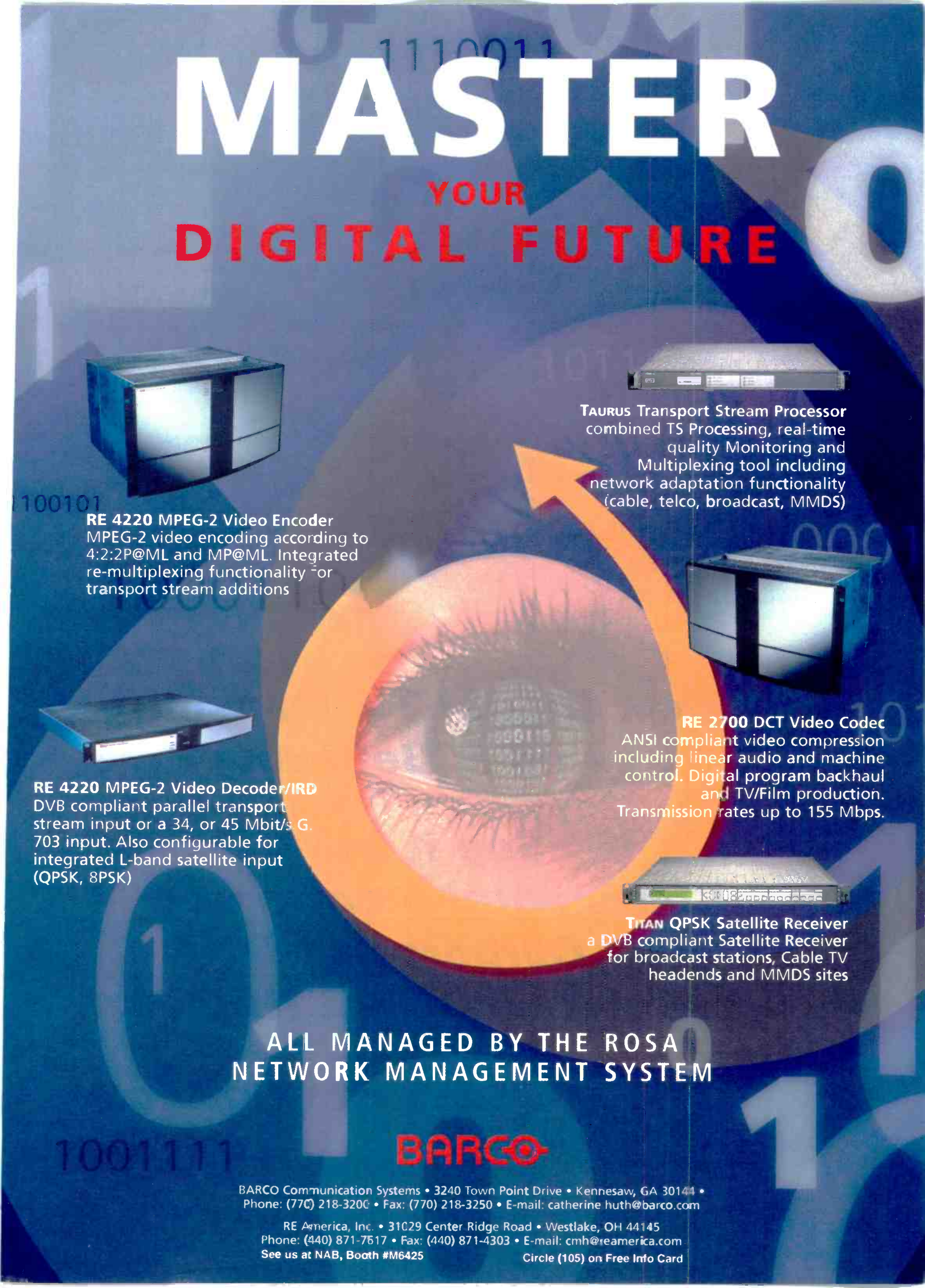
RT-SET Larus and Ibis: these systems enable real-time integration of live talent with 3-D virtual sets for live and taped broadcast and cable television, post-production, interactive programming and other content-intensive video production; 408-938-2330; fax 408-986-0452

Circle (381) on Free Info Card

TRIPOD HEAD

Bogen Manfrotto pro video tripod head: new range of features; tripod can support cameras from 14 to 23 pounds; complements the original 510 head; provides advanced three-step drag system for 360° and +75° to -70° tilt with smooth stop and starts; info@bogenphoto.com; www.bogenphoto.com

(498) on Free Info Card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See us at NAB, Booth #M6425
Circle (105) on Free Info Card

SNEAK PEEKS

AUTOMATED LIVE TV PRODUCTION WITH ONE-PERSON CREW

ParkerVision PVTV: an automated live and live-to-tape production environment where one person can simultaneously orchestrate multiple cameras, switch video, mix audio, key graphics, control VTRs and scroll scripts; at the heart of the PVTV, is CameraManSTUDIO, a fully automated live and live-to-tape production system; 904-737-1367; fax 904-731-0958; www.parkervision.com; parkerv@jaxnet.com
Circle (385) on Free Info Card

VIRTUAL SET SYSTEM COMPOSITION AND CONTROL SOFTWARE

Evans & Sutherland FuseBox release 3.0: this software program for the MindSet system composes, animates and controls all aspects of virtual set production; release 3.0 has twice the number of features and functions of the earlier version; 801-588-1920; fax 801-588-1925
Circle (384) on Free Info Card

FLUID HEAD

Miller Arrow 50: a fluid head that now supports a wide range of ENG, EFP and film camera configurations with an extended four-position counterbalance to complement its seven-position pan/tilt drag range; Arrow features rear-mounted major controls and indicators; counterbalance, pan/tilt drag and bubble levels that illuminate are all available at the push of a button; 973-857-8300; fax 973-857-8188; www.miller.com.au; mfhusa@aol.com
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- Digital downstream keyer
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SNEAK PEEKS

CAMERAS, LENSES, ACCESSORIES

PHOTOGRAPHER'S VEST

Porta-Brace video vest: this vest for ENG and EFP photographers consists of a soft inner layer and an outer layer made of a mid-weight Cordura fabric that is durable and waterproof; pockets are included for batteries, tapes, tools, secure passport and wallet, pens, rain slicker, ID, lunch and a cigar; adjustable side tabs allow extra room over sweaters; side zippers provide extra freedom; 802-442-8171; fax 802-442-9118

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HIGH-RESOLUTION LENS

Angenieux HR series: lenses designed to deliver the closest video quality you can get to film; the lenses feature the company's assisted internal focusing (AIF) system, and the HR 12X5.3 AIF wide superzoom features the longest zoom capability in its class; 973-812-3858; fax 973-812-9050

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TRIAXIAL CAMERA CONNECTORS

ADC Telecommunications ProAx line: easy-to-terminate connectors with innovative features such as field repairable center conductors that eliminate the need to restrip, on-site gender reversal, O rings that provide superior sealing against moisture, fewer parts to assemble and compatibility with the tooling you already own; it is available off the shelf; 612-938-8080; fax 612-946-3292; www.adc.com

Circle (391) on Free Info Card

TRIAX/COAX CAMERA CONTROL SYSTEM

Telemetrics TM9660: a triax/coax camera control system with newly designed adapters and added features; the CE-approved TM9660 is designed with component transmission to interface directly to digital converters; it can also connect directly to Telemetrics pan/tilt mechanisms for complete CCU functions, along with robotic functions over a single triax or coax cable; 201-848-9818; fax 201-848-9819

Circle (394) on Free Info Card

COMPRESSION EQUIPMENT

MPEG-2 ENCODING SYSTEM

Vela Research Argus 3.0: a Windows NT-based MPEG-2 encoder system designed for a broad range of professional applications that require broadcast-quality digital video; Argus has an extensive range of encoding capabilities for multimedia applications, as well as high-quality broadcast applications like digital ad insertion and video-on-demand; new features include variable bit rate encoding, caching FTP, improved API and inverse telecine; 813-572-1230; fax 813-573-2508; www.vela.com

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It's a tough RF world out there – and it's getting tougher. Fewer open TV channels. More wireless everywhere. And advanced digital television will soon be coming to a city near you.

Vega's EMP (Embedded Micro-Processor) Series takes these challenges in stride, while giving you the Emmy award winning audio quality you've come to expect from Vega.

EMP technology in the transmitters offers "intelligent" frequency agility and audio control, allowing you to reprogram UHF frequencies as often as needed, along with precise digital control of mic gain.

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COMPUTERS & PERIPHERALS

NETWORK MANAGEMENT AND CONTROL

Drake D-NAS: this system allows centralized management and control of transmission networks via over-air commands; it allows the broadcaster to carry out remote switching and reconfiguration, as well as monitoring off-site transmission equipment in the MP-2 environment; +44 1727 871100; fax +44 1707 393530; www.drake-automation.com; information@drake-information.com

Circle (400) on Free Info Card

DESKTOP VIDEO

ADDITIONS TO TARGA FAMILY

Truevison expanded TARGA line: new and more powerful additions to the TARGA product line include real-time uncompressed technologies, 3-D DVE add-ons, new open standards and an expansion of the company's workstation product line; 800-522-TRUE; fax 408-562-4065; www.truevision.com

Circle (402) on Free Info Card

DESKTOP VIDEO SYSTEM

LEITCH-ASC BrowseCutter: this product provides MPEG-1 digital video to the desktop through a custom applet that will work with standard graphical browser programs; the applet streams video with time code and provides access to the VR300's SpotBase software for monitoring the server's on-line inventory of available video; BrowseCutter provides a low-resolution, frame-accurate version of all media that exists in the broadcast-quality VR300 video server to all workstations on the network; rundowns and scripts can be sent v a Ethernet as a rough time line to a NEWSFlash editing system for finishing; the system will support third-party newsroom automation systems; 818-843-7004; fax 818-842-8945

Circle (403) on Free Info Card

GRAPHICS & ANIMATION SYSTEMS

WEATHER GRAPHICS SYSTEM

AccuWeather Ultra Graphix version 2.05: this weather graphics workstation integrates customized maps, comprehensive weather information and animated icons on the same screen while rendering all images in full 3-D perspective; it also allows users to convert from 2-D to 3-D perspective with a click of the mouse; the new system can quickly animate storm tracks, such as hurricanes, with the new Animatrak rendering; in addition, it has the ability to edit and save weather modeling data, as well as render the data into ready-to-air graphics; 800-566-6606 or 814-237-0309; fax 800-683-6329; www.accuweather.com; info@accuwx.com

Circle (405) on Free Info Card

EDITING, VISUAL EFFECTS AND GRAPHICS CREATION AND PLAYBACK SYSTEMS

Discreet Logic FIRE-HD, INFERNO, FROST: new and enhanced versions of products include the FIRE-HD on-line non-linear, non-compressed editing system designed for the high-bandwidth requirements of HDTV; the INFERNO resolution-independent visual effects system, which offers a new film tools module; the FROST 3-D broadcast graphics creation and playback system is designed for over-the-shoulders, full-screen graphics, titling and DVE effects; FROST, which will be demonstrated on the Silicon Graphics OCTANE, offering a most cost-effective solution for broadcasters, is upgradeable to the VAPOUR virtual studio software; 514-393-1616; fax 514-393-0110; info@discreet.com; www.discreet.com

Circle (406) on Free Info Card

CONVERTERS

YEM EDC-7000, HSC-1125D1A, SSC-1000: the EDC-7000 Super Up Converter converts NTSC video signals into RGB signals, allowing the NTSC to fit into the scan lines and the horizontal dots on the LC display or DMD projector; the HSC-1125D1A HD digital upconverter converts real-time D-1 signals into HD SDI signals; the vertical and horizontal picture size and position in the frame are freely variable between three fixed modes; the ADA-1125 HDTV AD/DA converter provides double functions in a single unit, converting HDTV analog (YPbPr/GBR) to HDTV digital signals (serial/parallel) and vise versa; the SSC-1000 NTSC/HD sync converter converts NTSC blackburst signals into three-level HDTV sync signals and vise versa; 310-544-9343; fax 310-544-9363

Circle (407) on Free Info Card

VIDEO INTERFACE FOR O²

Ensemble Designs Carbon analog I/O for SGI O²: provides analog video and key interface for Silicon Graphics O²'; Carbon is great for those using O² with a beta deck or other analog gear for graphics applications; provides full 10-bit processing; 530-478-1830; fax 530-478-1832; www.ensembledesigns.com

Circle (408) on Free Info Card

MOTION EFFECTS SOFTWARE

Inscriber CG/Xtreme: a motion effects software for Windows NT that enables artists and video producers to create multiple layer animations consisting of text, logos, backgrounds and draw objects; TV broadcasters and post houses can create an unlimited range of effects that previously required dedicated DVE hardware systems costing thousands of dollars more; 416-391-4500; fax 416-391-1999; www.inscriber.com

Circle (409) on Free Info Card

INTERCOM, IFB PRODUCTS

DIGITAL IFB CONTROLLER

Comtek DX 3-4: this controller has easy-to-learn control features with matrix routing connections to four universal inputs, three outputs and two I/O ports used for direct interface from cell phones, telco lines and standard two- or three-wire intercom systems; any function designated IFB may be vox operated with automatic programmable attenuation; 801-466-3463; fax 801-484-6906

Circle (410) on Free Info Card

TELEPHONE INTERFACE

Clear-Com TEL-14: this two-line, auto-nulling telephone interface for the Matrix Plus digital intercom systems allows up to 16 separate phone lines to be interfaced in three rack spaces; the unit can also be mixed with any of the other available interface cards in the frame; the interface automatically nulls at the beginning of the first telephone call, establishing the best possible connection between the matrix system and the outside line; from then on, it will undetectably null and echo cancel in the background; 510-527-6666; fax 510-527-6699; www.clearcom.com

Circle (412) on Free Info Card

What's In Your Digital Future?

SYNCHRONIZER? For performance, features and value, broadcasters prefer DPS synchronizers. Like the 10-bit DPS-465 Serial Digital Synchronizer with D1, component, Y/C and composite video I/O. Or the versatile DPS MicroSYNC™ line of modular video and audio synchronizers. Systems from one to 32 channels are easy to configure and economical to expand. ***From $1,495***

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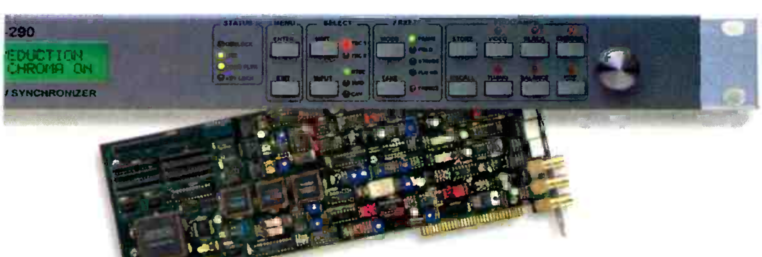

TIME BASE CORRECTOR? Our first digital time base corrector, the DPS-1, was introduced over twenty years ago. Later we developed the world's first TBC on a PC card. Today, we offer the industry's widest assortment of rackmount and PC card based models. ***From $850***

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Asia-Pacific: 61-2-9586-0088 Fax: 61-2-9586-0988
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Circle (119) on Free Info Card

SNEAK PEEKS

WIRELESS INTERCOM SYSTEMS

Telex Radiocom BTR-600 and BTR-500: the BTR-600 is a full-duplex, two-channel encrypted digital system featuring a UHF transmitting belt pack and receiving base station; it addresses two independent channels of a wired intercom from the base station; the system operates in the 524MHz to 608MHz and 614MHz to 746MHz frequency bands and integrates into any two-wire or four-wire Telex, RTS or other intercom system; the digital encryption scheme offers a cipher code of 65,536 possible combinations; the BTR-500 is identical to the BTR-600 without the digital encryption system; 612-884-4051; fax 612-884-0043

Circle (413) on Free Info Card

LIGHTING EQUIPMENT

LIGHTING AND SUSPENSION PRODUCTS

Sachtler Corporation of America products: the motorized Pantograph offers extensions up to 33 feet and computer-controlled positioning; robotic Studio Lights offer a motorized yoke for fresnel lens spotlights, a motorized focus module and motorized four-leaf barndoors; the Studio 2000, a PC Windows '95 or NT-based positioning control software for studio suspension equipment and motorized lights; 516-867-4900; fax 516-623-6844

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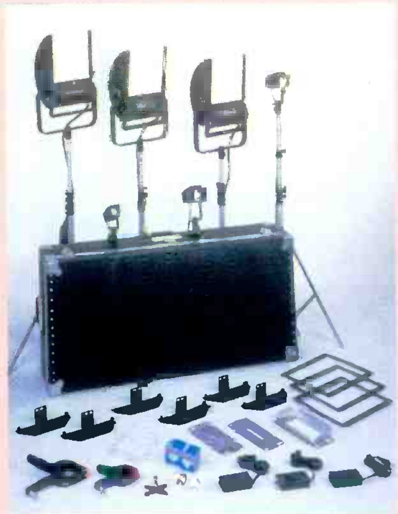
SNEAK PEEKS

LIGHT KIT



Pana-Tek Cool-Lux COMBO/SOFT Kit: this kit designed around the Cool-Lux Combo-Light, which accepts 300W, 500W, 750W or 1,000W double-ended lamps with a Softlight Hood to prevent projecting heat on the subject; the COMBO/SOFT Kit contains three Combo-Lights, barn doors, Softlight Hoods, diffusion accessories and 500W bulbs; the kit also contains two lightweight AC/DC Mini-Cools with 250W lamps, four-way barn doors and dimmers; for DC applications, the kit contains a 12V, 22W bulb and daylight filter assembly; a 35W, 12V Micro-Lux is included for ENG requirements; 805-482-4820

Circle (415) on Free Info Card

HALOGEN OR ARC CAMERA LIGHT

PAG Ltd. Paglight: interchangeable plug-in lamp units allow variants of unit type or wattage to be changed without requiring the user to handle the quartz envelope; a PowerMax control unit incorporates a voltage-control unit, which incorporates a voltage control circuit that extends battery run time and improves lamp filament life, while ensuring a constant and correct color temperature output; the PowerArc option can be plugged in to convert from halogen to metal-halide arc; the light is continuously focusable from spot to flood with an even spectral distribution; a multidirectional mounting system allows the light to be

VIRTUAL LIGHT PROCESSOR

Haplotec VLP 5000: a digital light processor that eliminates out-of-the-studio lighting problems by adjusting light content pixel by pixel in real time; the VLP 5000 is designed specifically to decipher highlights and shadows to create a more realistic image; ENG crews, sports broadcasters and other video professionals can use the VLP 5000 to improve loss of detail due to extreme shadows or brightness; 408-573-9000; fax 408-573-7067; www.haplotec.com; info@haplotec.com

Circle (418) on Free Info Card

PORTABLE LIGHTING SYSTEMS

Kino Flo UL-approved lighting: UL safety lighting for portable fluorescent fixtures; system meets new UL safety standards for patented Kino Flo fluorescent designs; 818-767-7517; fax 818-767-

LIGHTING EQUIPMENT

Cool-Lux COOL-Brick: the new and improved Brick is designed so that there is no recessed pin to wear out and the casing opens so it is capable of recell servicing for years of use; a key optional feature is a specially lighted panel on the front of the COOL-Brick that can display the broadcast organization's name; a master on/off switch governs the COOL-Brick so it will not discharge even when attached to the camera; the COOL-Brick is available in 13.2 and 14.4 voltages; 805-482-4820; fax 805-482-0736

Circle (421) on Free Info Card

LIGHTING EQUIPMENT

Blaine Lentz Lighting Associates ProLens, ProMic, ProBaby: the ProLens shade eliminates the need for flare compensation and continuous riding of black levels by providing maximum flare protection at every focal length and on every box type lens; the ProMic components for mounting effects mics can be used on all flat and round surfaces, ranging from hard camera lenses to padded stadium railings and gang poles; 818-887-7148; fax 818-887-4472; Tvlights@worldnet.att.net

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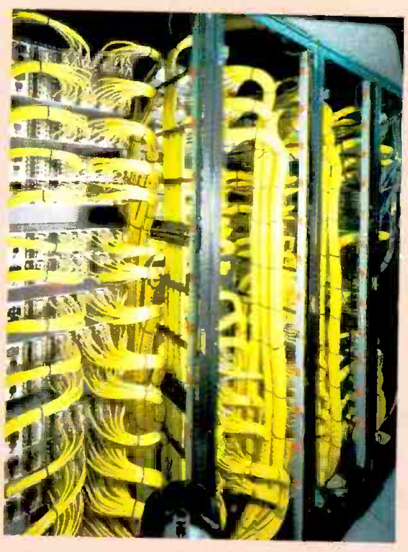

SNEAK PEEKS

MICROPHONES, ACCESSORIES

CONDENSER MICROPHONE

Sennheiser MKH 2-80: a series of RF condenser microphones designed for recording the most exacting criteria; the microphones feature low inherent self-noise for exceptionally accurate sound reproduction and high sensitivity ensures an excellent signal-to-noise ratio, even for weak signals; the low weight and durable light metal design make them suitable for outdoor applications; 860-434-9190; fax 860-434-9022; www.sennheiserusa.com; miclit@sennheiserusa.com

Circle (423) on Free Info Card

WIRELESS MIC RECEIVER

Sennheiser EM3532: this two-channel, computer-controlled, true-diversity unit offers 32 programmable UHF receiver frequencies and circuitry incorporating PLL synthesis; features include a 40Hz to 20kHz frequency response, 434MHz to 960MHz frequency range, maximum switching bandwidth of 24MHz and a companion noise reduction system that results in a 100dB S/N ratio; 860-434-9190; fax 860-434-1759; www.sennheiserusa.com

Circle (422) on Free Info Card

TWO-CHANNEL UHF SYSTEM

Nady Systems Platinum 802 series: this two-channel UHF system offers professional features and DigiTRU Diversity, packaged in a system costing less than many single-channel UHF systems; it consists of an ultracompact rack-mountable receiver with dual front-mounted antennas, adjustable line "1/4" and fix mic level XLR outputs; it also features a full range of transmitter options, including durable hand-held, lavalier, instrument and head mics; 510-652-2411; fax 510-652-5075; www.nadywireless.com

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PRODUCTION SWITCHERS & VIDEO EFFECTS, KEYERS

A/B DIGITAL LINEAR KEYER-SWITCHERS

PSP Digital Ltd. PVS-4, PVS-2: the stand-alone PVS-4 is capable of true 4:4:4 signal processing and incorporates a PC-based design that provides the flexibility to integrate third-party signal processing hardware; the unit can be controlled under GVG emulation from a PC or workstation or it can be used with an optional control panel; the PVS-2 4:2:2 is for autoconforming and graphics composition applications; 44-1635-522-534; fax 44-1635-551-995; www.psp-digital.co.uk

Circle (427) on Free Info Card

REMOTE CONTROL OPTION FOR MIRAGE

Sierra Video Systems mini-production switcher control for Mirage: a new remote-control panel option is available for the Mirage real-time digital image compositing system; the new panel unveils a small production switcher built into Mirage; the panel can be used with Mirage's on-screen graphical user interface and has a trackball mounted in the middle that provides control of all functions that the mouse can operate in addition to a level arm mode; other Mirage production features include standard protocol-based editor interface, auto-transition and look-ahead preview; 530-478-1000; fax 530-478-1105; www.sierravideo.com; sales@sierravideo.com

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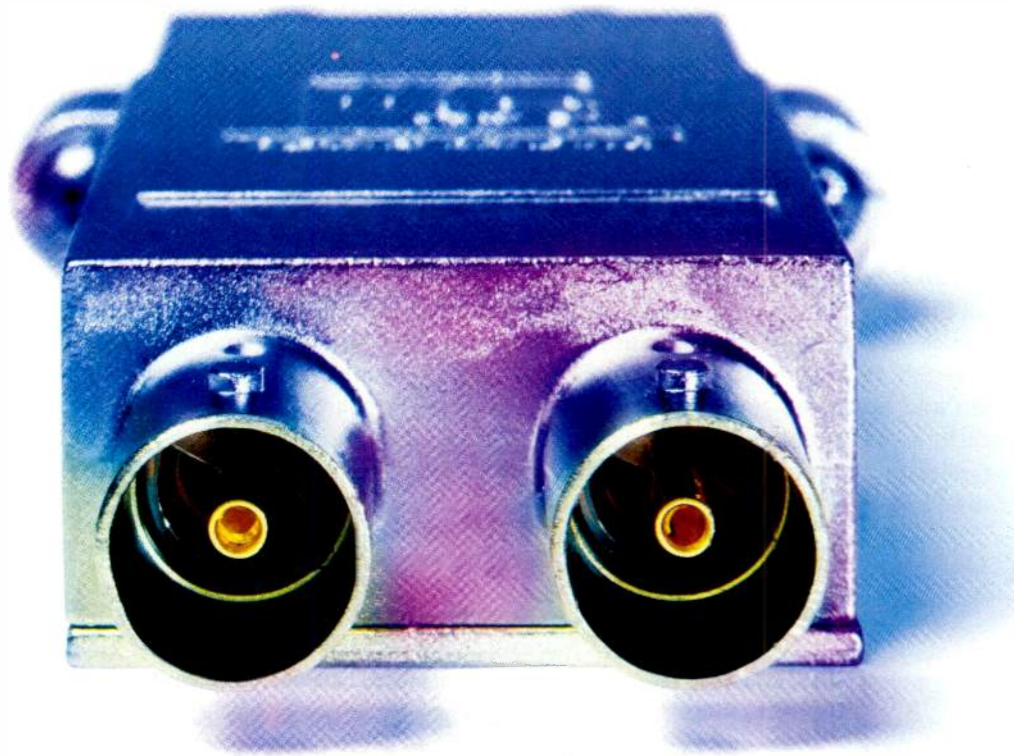
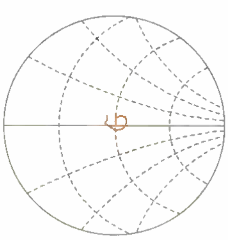
Finally, a place to stick the FCC's DTV requirements.

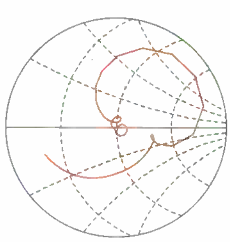


Introducing the world's only video jacks to surpass SMPTE® 292M specifications for uncompressed HDTV.

You're looking right up the business end of the SVJ-2 Super Video Jack from ADC Telecommunications. A breakthrough jack that can do far more than help convert your station to digital television — it will take you all the way to HDTV. ■ That's because ADC Superjacks don't just pass SMPTE 292M specs, they blow them out of the water. Our standard-size SVJ-2, for example, can handle bandwidths up to 2.4 GHz. And our mid-size MVJ-3 can go to 3.0 GHz and beyond. Which means these jacks could realistically outlive your entire network. That's why we call them "future proof." No matter what DTV format your station adopts now, you won't have to upgrade again. ■ ADC Superjacks. The best place in the world to stick FCC requirements for DTV. ■ As you'd expect, ADC is innovating the broadcast industry.



No other jacks on the market come close to the performance of ADC's Superjack family.



The impedance performance of the nearest competitive jack spirals out of control.

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SNEAK PEEKS

COMPONENT DIGITAL/ ANALOG VIDEO MIXER, D-1-TO-ANALOG CONVERTER

Video GainesVille MightyMix, MightyCoder: the MightyMix eight-input mixer is integrated into a one-piece package measuring only 17"Wx13.5"Dx5.8"H; a preprogrammed DVE option adds 100 ready-to-use 3-D effects; the MightyCoder D-1-to-analog converter measures 4.2"x3"x1.25" and weighs less than eight ounces without power supply; 352-372-0270; fax 352-378-5320

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COMPOSITING AND SPECIAL EFFECTS TOOL

Chyron Concerto: an aggressive full-service compositing and special effects tool for Windows and Windows NT workstations; it supports unlimited layers of video and audio and provides users with filters, compositing and roto-matte automation features; the user can edit a series or rendered sequences, then add transitions; the system supports a range of resolutions from icon-size to full high-resolution images above 1,280x1,024; the user can output lower resolution views for faster preview and compositing; 516-845-2026; fax 516-845-3895; www.chyron.com

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SNEAK PEEKS

DIGITAL VIDEO MIXER WITH 3-D DVE EFFECTS

FOR-A VPS-400D/DP: a serial digital component I/O video mixer with DTV operation; it includes a built-in floppy disk drive to upload/download operational data and multiple add-on features are available, including real 3-D DVE effects, chroma- key, tally out, analog composite outputs (program/preview), LAN 10BASE-T interface; 714-894-3311; fax 714-894-5399; forascb@aol.com

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RECORDING MEDIA & ACCESSORIES

VIDEO-CASSETTES

Quantegy Digital Betacam videocassettes: the DBC formulation provides superior operational and archival performance in extreme environments; it offers high durability and output, combined with consistency and reliability; the coactive site binder system is designed to improve cross-linking and reduce debris; other features include a precision high-impact cassette mechanism, advanced anti-static plastics, Quantegy's exclusive labeling system and convenient cassette sizes from six to 124 minutes; 800-752-0732 or 770-486-2800; fax 800-628-0535

Circle (434) on Free Info Card

DIGITAL EIGHT-TRACK TAPE

HHB DA113: this digital eight-track tape is optimized for Tascam DA88 and Sony PCM800 digital audio eight-track recorders; the DA113 features superior quality and 113-minutes in length; it also features a specially formulated metal binder that is key to ensuring a negligible drop-in output after the repeated playback cycles required in professional applications; the bond between the ultrafine metal particle recording layer and the bass film of the HHB DA113 is so strong that even after 100 passes, the measured drop-in output is less than 0.5dB; 310-319-1111; fax 310-319-1311; sales@hhbusa.com

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VIDEOCASSETTES

Quantegy Betacam SP: BSP is specifically designed for the picture-perfect performance required for critical applications; it provides excellent picture and audio reproduction for professional ENG/EFP and studio applications; manufactured under stringent quality controls, the videocassettes feature ultrafine metal particle and dimensionally stabilized polyester backing that prevents skew errors and maintains low dropout rates; 800-752-0732 or 770-486-2800; fax 800-628-0535

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Designed to accommodate today's as well as tomorrow's video and audio interfacing requirements
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SNEAK PEEKS

STUDIO & FACILITY SUPPORT PRODUCTS & ACCESSORIES

TIME-CODE CONVERTER

Evertz 8010 digital time-code converter: provides accurate conversion of time of EBU to SMPTE time code; also provides D-VITC generator, LTC to D-VITC translator and character insertion; analog monitor option; 905-335-3700; fax 905-335-3573; sales@evertz.com; www.evertz.com

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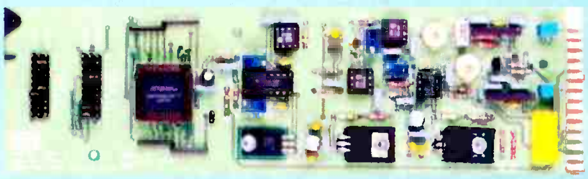


VBI DATA BRIDGE

Broadcast Video Systems VBI-10 data bridge: solves problems in video processing and time-shifting equipment; VBI-10 can help reinsert original data, VITS and closed-captioning on the outgoing video; can also delete unwanted data from selected line, move selected VBI from one signal and insert it into another; 905-764-1584; fax 905-764-7438; bvs@bvs.on.ca; www.bvs.on.ca

Circle (439) on Free Info Card

DESKTOP VIDEO RACK

MetaWave MW12: this rack is a space-saving case that holds two MW series signal processing boards and is designed for use in desktop video and other applications where space is restricted; the unit can accommodate MW audio and video converters, as well as audio embedders/extractors; 44-1635-299000; fax 44-1635-299299; info@metawave.co.uk; www.metawave.co.uk

Circle (440) on Free Info Card

VIDEOTAPE CLEANING AND EVALUATION FOR DVCPRO CASSETTES

RTI/Research Technology International TapeChek TC 5100: this products lets you confidently recycle your videotapes quickly and easily; the TapeChek cleans and polishes the tape surface, removing loose particles and dust; a high-resolution defect detector locates tape damage preventing avoidable tape failure; a tape information display shows tape length in minutes and the number and location of any physical defects; the unit recycles a two-hour tape in as little as three minutes; 800-323-7520 or 847-677-3000; fax 800-784-6733 or 847-677-1311; www.rtico.com; TapeChek@rtico.co

Circle (435) on Free Info Card

FILE SERVER STATION

Winsted: LRx series: a modular series of file server stations featuring steel, L-Frame architecture; components can be mixed and matched and each system includes smooth rolling wheels; the basic L-frame comes with a stationary server shelf for multiple servers or a pullout server shelf for individual servers; the sliding server shelves have optional retractable cable lacing guides to help keep cables in place while the server is pulled out; pull-out keyboard shelves, deep enough to hold three keyboards, come in flat or tiered versions; 800-559-6691 or 612-944-9050; fax 612-944-1546; www.winsted.com; racks@winsted.com

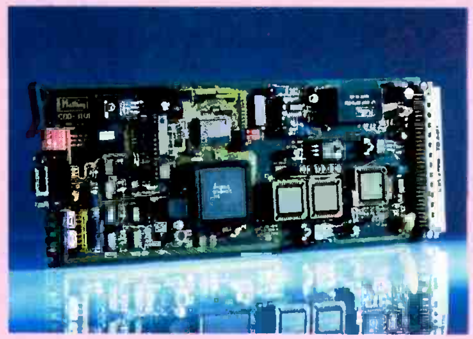
Circle (441) on Free Info Card

SNEAK PEEKS

TBCs, FRAME SYNCS & CONVERSION EQUIPMENT

NTSC/PAL DECODER

Television Equipment Associates CDD-3101: Matthey Electronics has a single-card, the CDD-3101, that offers high-quality three-line adaptive comb filter decoding, with 10-bit internal processing; composite analog signals are converted from NTSC/PAL directly into serial digital component 4:2:2 format; for better distribution, the Matthey decoder has four serial D-1 outputs; 914-763-8893; fax 914-763-9158



Circle (442) on Free Info Card

MINIATURE ENCODERS/DECODERS AND CONVERTERS

Miranda Technologies picoLink: this series of micro products offers a variety of stand-alone interfacing options, including component or composite analog to 4:2:2 decoder, S-Video to 4:2:2 decoder, composite to CAV or S-Video decoder and ARC, and composite aspect ratio converter; 514-333-1772; fax 514-333-9828; www.miranda.com

Circle (444) on Free Info Card

VIDEO SCAN CONVERTER

RGB Spectrum Videolink 1650: a video scan converter that accepts interlaced or non-interlaced RGB inputs from virtually any workstation or desktop computer (with screen resolutions up to 1,600x 1,200 pixels); the new RGB/Videolink model will output broadcast-quality NTSC and PAL composite video, S-Video and component analog video (CAV); features include zoom function, broadcast-quality gen-lock and three levels of flicker filtering; the system saves programmable set-ups in non-volatile storage and allows for user-definable zoom pre-set on the front panel; 510-814-7000; fax 510-814-7026; www.rgb.com

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Losing out to the competition?

Punch up your productions...

MightyMix

ANALOG/DIGITAL VIDEO MIXER

- Analog and digital component I/O capable.
- Compact and simple single unit design.
- 8/10 bit (digital), RGB/YPBPR (analog) select inputs.
- 8/10 bit (digital), YC/RGB/YPBPR (analog) select outputs.
- Many user demanded features and options.
- Preprogrammed DVE option adds 100 ready-to-go 3D effects.
- Excels in small edit suite or limited space applications.

MightyCoder D/A

DIGITAL-TO-ANALOG CONVERTER

Compact, low cost digital-to-analog converter. Accepts serial digital component; outputs 2 reclocked serial digital, 1 analog composite, and 1 analog output selectable as composite/YC/RGB/YPBPR. Selectable digital filters. Component outputs interpolated to 4:4:4, composite/YC to 8:8:8. 10bit hi-res DACs, selectable digital filters, amp. adjust, sync on/off. Built-in color bar generator and signal presence indicators.

CV60

COMPACT COMPONENT DIGITAL MIXER

Designed for budget conscious users, the single M/E CV60 digital component mixer with user friendly control panel delivers superb support, commonly demanded functions. Croma key standard, optional adv. wipe pattern capability.

CV120

COMPONENT DIGITAL VIDEO MIXER

Designed for superb support, but with economy in mind, the single M/E CV120 component digital mixer is perfect for telecine, small edit suite, and other system applications.

CV332

COMPONENT DIGITAL VIDEO MIXER

Provides 2 M/E and PGM/PST buses, 2 DSK channels, plus up to 8 optional AUX buses. ASIC technology design. Up to 2 keyers, key mask buses and priority bus possible. Key modifiers, key breakaway, chroma key possible. Effects send bus ea. key source, fill. 16/32 bit internal processing (4:4:4:4 w/ DVE option). 8 color matte, 2 color background (w/ splash) generators. Preset wipes w/ modifiers. Full range of auto transitions, 4 internal advanced frame stores. Data unload/download, color correction options.

CV132

COMPONENT DIGITAL MIXER

Provides up to 32 serial digital inputs (16 standard), plus black, 4 program, 2 preview outputs possible. 2 ea. color background, advance wipe generators. Preset wipes w/ modifiers. 'Soft box mask' or wipe generator mask keys; flying 'variable soft' shadows, or other key modifiers. Auto transitions, adv. 2D filtering, foreground suppression for chroma keys. Event memory, standard editor interface protocol.

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For Technical Info:
VGV Inc. d/b/a Video Gainesville : 2400 N.E. Waldo Road, Gainesville, FL 32609, U.S.A. — +1 352-372-027[illegible], Fax : +1 352-378-5320

TEST & MEASUREMENT EQUIPMENT

AUTOMATED VIDEO SIGNAL MONITORS

Magni Systems AVM 510 N and T versions: these new versions of the AVM series offer the capability of unattended error detection and reporting of non-linear distortions and depth of modulation signal parameters; for on-site monitoring, errors can be logged with time/data stamps; for remote site monitoring, both measurements and waveforms can be retrieved with Magni LOGBOOK II software; the monitors support live video signal monitoring; out-of-limit conditions are flagged by the Smart Guard display and can be logged on a PC file or printed to a hard copy with a time/date or VITC time-code reference stamp; 800-237-5964; 503-615-1900; fax 503-615-1999; sales@magnisystems.com; www.magnisystems.com

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MPEG-2 TESTING PLATFORM

Hewlett-Packard E6277 MPEGscope Plus: a powerful, flexible and extensible platform for MPEG-2 DVB testing; it offers visualization of every detail from DVB and ATSC tables to video elementary stream analysis, including MPEG 4:2:2; the MPEGscope also features real-time analysis, such as ETR-290, PCR jitter and PID bandwidth, error-triggered capture and comprehensive post analysis to pinpoint every problem; 408-553-3001; www.hp.com/info/forhptv/; forhptv@vid.hp.com

Circle (446) on Free Info Card

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SNEAK PEEKS

EMF GRAPHICAL READOUT

Holaday HI-4460 hand-held EMF readout: provides large backlit LCD panel to display multiple numeric and graphical electromagnetic field representations; display can show resultant reading, individual axis readings, bar graphs, as well as a running time plot simultaneously; 612-934-4920; fax 612-934-3604; holaday@holaday.com; www.holadayinc.com

Circle (447) on Free Info Card

PORTABLE DUAL DOMAIN AUDIO/INTERFACE ANALYZER

Audio Precision Portable One Dual Domain: the newest addition to the Portable One family of audio analyzers, the product features a complete complement of digital interface testing and monitoring functions, including jitter generation and measurement, audio bit error rate, sample rate measurement and other interface functions; the new analog + digital + interface tester generates and measures analog and digital audio signals in their native domain; 800-231-7350 or 503-627-0832; fax 503-641-8906

Circle (448) on Free Info Card

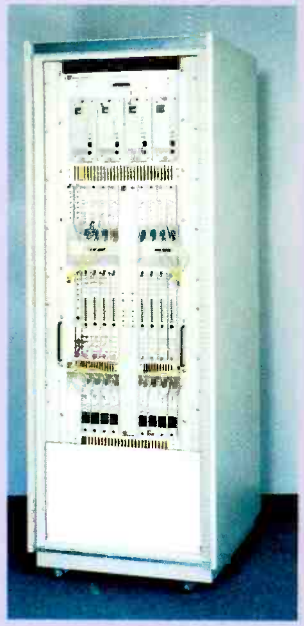
WIRELESS VIDEO SYSTEM

DynaPIX TRIAD: portable diversity wireless video system; contains up to five receivers, each receiver output is simultaneously evaluated; proprietary logic board switches to the best signal at the horizontal line rate minimizing the effects of multipath and fades; 800-233-8639; fax 603-880-6965; www.dynapix.com

Circle (453) on Free Info Card

VEHICLES & REMOTE SUPPORT EQUIPMENT

DIGITAL FIBER-OPTIC TRANSMISSION PLATFORM



ADC Broadband Communications DV6000: this multi-channel platform now supports 8-VSB modulated services, as well as a variety of video and data service interfaces; the DV6000 can transport up to 16 separate 8-VSB modulated channels directly at TV IF, allowing modulation equipment to remain within the studio; an option to transport a single 8-VSB IF channel over a fiber-optic cable is also available; 203-630-5700; fax 203-630-5701

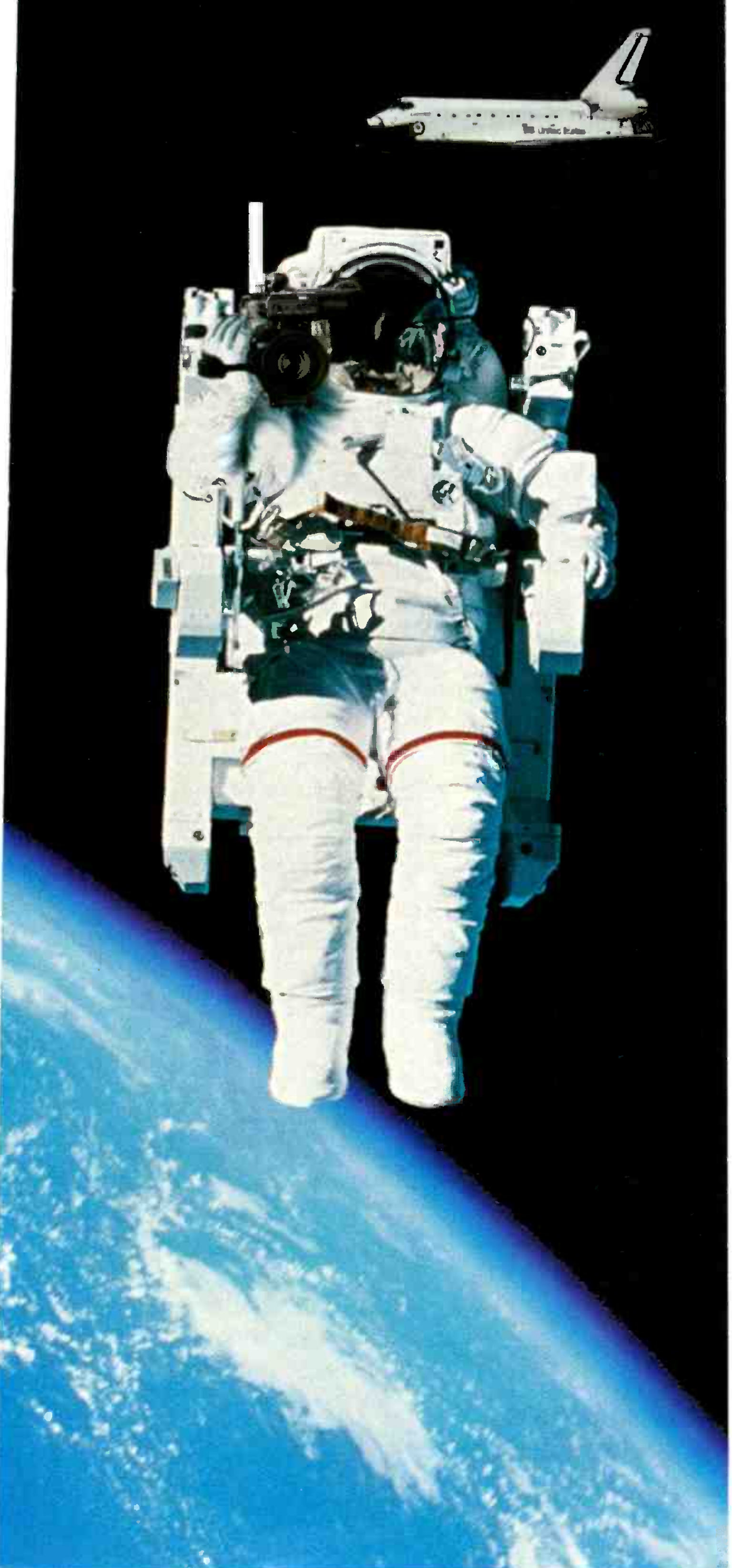
Circle (451) on Free Info Card

SAFETY PACKAGE FOR TELESCOPING MASTS

The Will-Burt Company D-TEC: this safety package includes four features: a bright, focused light at the top of the mast to illuminate the area above the antenna; a tilt detector to warn if the system is not vertical; an AC detection system that electrically senses voltage-carrying wires; and an anti-collision system to detect overhead obstructions in the path of the extending mast; 330-682-7015; fax 330-684-1190

Circle (453) on Free Info Card

Is your WIRELESS VIDEO assignment the toughest in the UNIVERSE...



CamLink II™
WIRELESS VIDEO

Or is it more down to EARTH?

EITHER WAY, DON'T BE TIED DOWN BY CABLES!

The CamLink II Wireless Video System is being used all over the planet to cover breaking news, sports, live events, and feature film production. Even spacewalking NASA and MIR astronauts who need to send broadcast-quality pictures back to their spacecrafts will use the CamLink II. You too can depend on CamLink II's reliability, stability and exclusive features:

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- **Timecode and Tally transmission create Instant Window Dubs™**

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TELEX®

Circle (114) on Free Info Card

SNEAK PEEKS

VIDEO DELIVERY SYSTEM

LEL Computer Systems Video Pipeline-2: this system delivers MPEG-2-quality video and audio over T1, E1, RS-422, Ethernet (MAC or IP Multicast Packets), ATM and V.35 at bit rates of 3Mb/s to 8Mb/s; the highest-quality compressed video can be used for cable distribution, teleconferencing, distance learning and security; DVB-compliant equipment can also be used; 561-347-2242; fax 561-347-6276

Circle (455) on Free Info Card

LINE OF FIBER-OPTIC COMMUNICATION PRODUCTS

Communications Specialties Inc. (CSI) fiber-optic line: as a result of CSI's recent acquisition of Math Associates, a manufacturer of fiber-optic systems, CSI is introducing six fiber-optic products, each suited to the unique needs of the teleconferencing and communications industries; the line includes Fibervision for video transmitter and receiver system, Fibervision for video/stereo transmission of a composite video (NTSC, PAL or SECAM), Fibervision for serial digital video for high-quality transmission of video signals, Fiberlink for balanced audio, Fiberlink for bidirectional data and Fiberlink for bidirectional T-1 data; 516-273-0404; fax 516-273-1638; www.commspecial.com

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SPORTS SERVICES

GlobeCast North America multiple downlink product: a turnkey sports service that enables clients to decrease costs to their rightsholders while maintaining quality services to individual rightsholders; GlobeCast has expanded its digital services via satellite to include all point-to-point and end-to-end offerings and all circuits worldwide are now digital; 617-520-9114; fax 617-547-5444; www.globecast.com

WIRELESS CAMERA SYSTEM

Global Microwave Systems STAR CAM: this system for single and multicamera remotes integrates a multiband microwave video/audio link with a telemetry link, providing full paint control for the camera, pan and tilt, as well as the video/audio link controls; features include simple set-up with two-wire interconnect for a single unit, modular hub allowing up to 10 controllers, ability to seamlessly add modules while on the air, ability to control numerous camera models without reconfiguration, ability to select 2GHz, 7GHz or 13GHz microwave bands with a change of antenna; 760-631-8021; fax 760-631-8031; gms@gmsinc.com; www.gmsinc.com

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Now with Special Pricing on Betacam SP®, guess what the SP stands for?

BVW Series

Now's the time to take advantage of Sony's highest quality Betacam SP format. BVW series list prices have been lowered by 15%. Key part prices have been lowered by 30% on average. And there is a new, extended warranty. The BVW series recorders and players deliver robust, solid performance under critical conditions, using either metal or low-cost oxide media. Expand and enhance your production capabilities with Betacam SP. There's never been a more affordable time to own Betacam SP. For more information on these special prices, call 1-800-635-SONY, ext. SP.

www.sony.com/professional

SONY

VIDEO EDITING SYSTEMS

ALL-FORMAT DIGITAL EDITING SYSTEM

FAST Electronic U.S. blue: this turnkey system operates under MPEG-2 (4:2:2p@ML); every in, any out format allows editors to use any digital or analog video format on the same system at the same time; data can be transferred via SDI, IEEE 1394 or QSDI interfaces; edits all video formats with no degradation by keeping the signal in its native digital state; offers 10-bit uncompressed component video and 20-bit digital audio; 650-295-3500; fax 650-345-3447; www.fastmultimedia.com

Circle (463) on Free Info Card

EDITING SYSTEM

Tri-Star DVE-4 and StudioStation DAW: DVE-4 provides dual Intel Pentium II processor-based video editing for broadcast and production applications; StudioStation DAW provides high-performance digital audio editing; 602-707-6450; fax 602-707-6451; www.tristar.com

Circle (464) on Free Info Card

DIGITAL VIDEO RECORDERS

Fast Forward Video Omega deck: this unit now has a Fiber Channel (100Mb/s) and serial digital interface that provides a new video input/output format to make it compatible with high-end facilities; the product is available in single-channel and dual-channel versions and the dual-deck version features independent and simultaneous record and playback capability; a dual-channel version with a built-in RAID controller and two independent channels with shared video storage is also available; 714-852-8404; fax 714-852-1226

Circle (467) on Free Info Card

EDITING SYSTEM

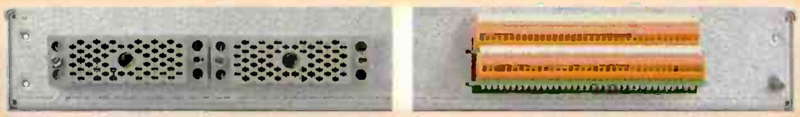
DNF Industries two machine, cuts only editing system: an editing system designed specifically for fast and easy-to-use news-style editing; the editor enables each operation to be completed quickly and accurately; the backlit four-line display quickly shows in, out and duration, and the commands are easily entered using a numeric keypad; the cuts only editor features off-speed edit capabilities that are easily implemented even during edits; while editing, creative decisions may be evaluated using Hot Punch features; 818-252-0198; fax 818-252-01909; // dnfindustries.com; info@dnfindustries.com

Circle (465) on Free Info Card

EASY PATCH

The Analog/Digital patch bays for today and tomorrow...from Neutrik®

Two choices to "wire up" Easy Patch for fast termination.



Jumpers behind each jack allows switching into 1 of 6 configurations, even after installation.

Flexible rack depth: NPP-TT/TB-14 allows you to go from 14" to 18" via built-in slider.

The Easy Patch series of easy to use patchbays eliminates signal degradation and offers excellent crosstalk performance required in today's broadcast facilities, mobile trucks, recording studios and audio installations.

Their analog/digital signal capability, reduced wiring time and quality workmanship are unmatched by competitors' patchbays.

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You asked for innovation, productivity and value in a patch bay series and Neutrik listened.

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SNEAK PEEKS

NLE EDITING SYSTEM

JVC MW-S1000: this all-in-one system is capable of 4:2:2 digital 2-D and 3-D effects, graphics, chroma-key and more; video and audio effects are done in real time with 4:2:2 processing at a 270Mb/s data rate that is virtually indistinguishable from D-1 uncompressed recordings; the unit can be configured from input to output with a variety of video paths, including all component serial digital, analog component, Y/C or composition; incorporated into the system are several different manufacturers' products that run under Windows NT 4.0 and use the Movie II bus; 800-JVC-5825; www.jvcpro.com.

Circle (466) on Free Info Card

EDITING SYSTEM

Leitch (ASC) NEWSFlash news editing system: uses shared storage for simultaneous recording and playback on both channels; shares a common Fibre Channel arbitrated loop technology; can record satellite feeds, edit news stories and play directly to air; 818-843-7004; fax 818-842-8945

Circle (468) on Free Info Card

VIDEO RECORDING, STORAGE, PLAYBACK & SERVERS

SOFTWARE FOR SPHERE NON-LINEAR SYSTEMS

Scitex Digital video SPORT: this software provides for fast and easy creation of sports highlight packages; during live recording from a feed, the Sphere operator can set a mark while play is under way and SPORT will create a clip with user-designated handles that capture the beginning and end of the play; 410-783-0600; fax 410-783-0606

Circle (471) on Free Info Card

VIDEO SERVER

Doremi Labs V1 Video server: provides fast access to huge libraries of recorded video for multiple users, networked to multiple stations providing full 4:2:2 resolution and variable compression ratios from 2:1 to 32:1; 213-874-3411; fax 213-874-3401; www.doremilabs.com

Circle (482) on Free Info Card

SNEAK PEEKS

FIBRE CHANNEL STORAGE

Storage Concepts Fiberaid: these network switched Fibre Channel storage solutions are for multiple video applications at 100MB/s; host platforms supported include SGI Impact, 02, Octane, Onyx, Challenge, PCI and Mac; 714-852-8511; fax 714-852-8930
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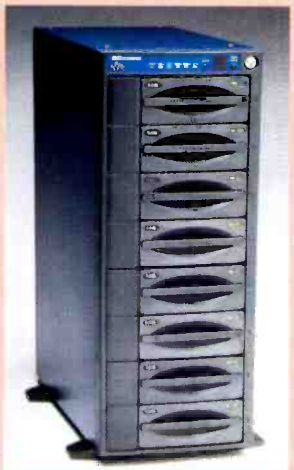
FIBRE CHANNEL DISK ARRAY



MegaDrive Systems Aria: this product features 200MB/s, full-duplex point-to-point throughput and GaAs LRCs for on-the-fly hot-swapping of drive modules; it can offer up to 72GB per enclosure with daisy-chaining and supports 7,200RPM Barracuda and 10,000RPM Cheetah Fibre Channel drive modules; features include an active low-noise Fibre Channel back-plane, software-based RAID data striping and mirroring and the ability to support up to 126 devices on a single loop or 16 million devices in a switched fabric; users can select an optional built-in four-port hub; 818-700-7600; fax 818-700-7601; sales@megadrive.com; www.megdrive.com
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CROSS-PLATFORM SOFTWARE

Transoft FibreNet: this software allows SGI, Windows NT and Mac workstations to access the same high-speed storage systems with workstations to access the same high-speed storage systems with on-the-fly format conversion; also demonstrated will be a switched Fibre Channel network that includes network speeds of several hundred megabytes per second; 805-897-3350; fax 805-897-3355; www.transoft.net
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DIGITAL DISK RECORDER

Accom APR-Attaché digital disk recorder: long-play video storage designed for TV post production; provides non-destructive PreRead and unique KeyTrack option for V+K or digital RGB recording; 650-328-3818; fax 650-327-2511; www.accom.com
Circle (481) on Free Info Card

SNEAK PEEKS

STILL-STORE

Miles M25 Not-So-Still-Store: featuring a radical architecture, this product allows real-time multilayer compositing of SDI stills, logos and animated clips; two stored images with keys and an external fill and key input can be composited over a live video background in real time; these capabilities are duplicated on a second channel to allow true look-ahead preview and rehearse; a wipe generator provides frame comparison in telecine use or mixer/switcher functions when used in a broadcast presentation environment; the M25 enables instant grab of stills or animations, including keys, while on air; the 160-frame video RAM cache allows instant recall of pre-selected images and an internal hard disk and PCMCIA memory card provides non-volatile bulk storage; +44 (0) 1635 552 524; fax +44 (0) 1635 552 858

Circle (479) on Free Info Card

VIDEO DISK RECORDER

MountainGate CentraVision 6200 VDR: VDRs based on Fibre Channel network attached storage; when used in conjunction with the CentraVision file system, the VDRs allow shared access to the recorded media; with the CV6200, storage can be expanded as needed to more than 40 hours uncompressed; the CV6200 features similar VTR-like control from the front panel, eight- and 10-bit support and support for CCIR 601, 525 and 625 inputs and outputs, as well as analog composite inputs; 702-851-9393; 800-556-0222; fax 702-851-5533; www.mountaingate.com

Circle (484) on Free Info Card

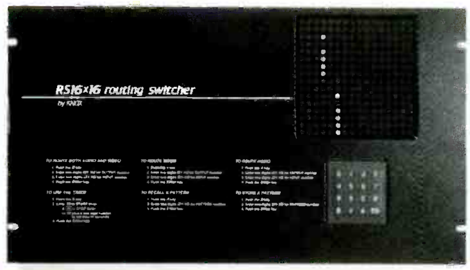
DISK RECORDER

Hewlett-Packard MediaStream: a digital storage and playback solution that provides smaller stations with an affordable, easy-to-use entry into multichannel, disk-based technology; it can also serve as a cache to a cart machine for spot insertion; featuring high functionality in a small space, the MediaStream offers up to five channels and 18 hours of integrated RAID-protected storage, MPEG-2 video compression and Fibre Channel networking; 800-452-4844; fax 408-553-3001; www.hp.com/info/forhptv/; forhptv@vid.hp.com

Circle (480) on Free Info Card

SNEAK PEEKS

VIDEO ROUTING & DISTRIBUTION



ROUTING SWITCHER

Knox Video RS16x16, RS16x16BAL: these full-matrix routing switchers are housed in an ultrathin chassis and offer maximum video bandwidth to 200MHz; the balanced audio headroom is greater than 18dB and plug-in Phoenix connectors are used for balanced stereo audio; 301-840-5805; fax 301-840-2946; www.knoxvideo.com

Circle (486) on Free Info Card

DATA LINK

Egripment serial data link: this product reduces the number of cables by running the controls for the remote head, the video signal and the lens controls down a single BNC cable; it can also operate via a fiber-optic cable, a modem or a transmitter; a lens selector switch allows the user to adjust controls to suit the specs of the lens; 818-787-4295; fax 818-787-6195

Circle (487) on Free Info Card

PASSIVE SWITCHERS

Multidyne SW-5S and SW-10S: these video and stereo audio passive switchers allow users to select one of five and 10 video and stereo audio sources, respectively; unselected video inputs are terminated in 75Ω; unselected audio input are terminated into 600Ω; the SW-5S features 12 XLR audio connectors and six BNC video connectors; the SW-10S features quick-release, pluggable, screw terminal audio connectors and 11 BNC video connectors; both are available in tabletop and rack-mount configurations; 800-4TV-TEST; 516-671-7278; fax 516-671-3362

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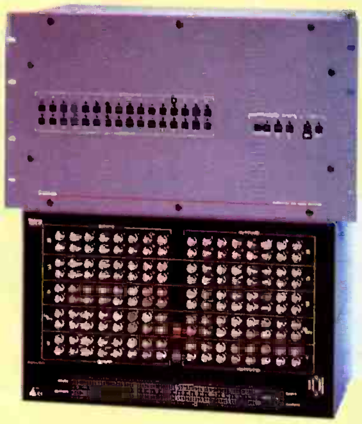
SNEAK PEEKS

AUDIO AND VIDEO ROUTING SYSTEMS

NVISION processing modules: new series of audio and video signal processing modules; DA4010 AES DA; DA4030 dual AES A/D converter; SG4410 master digital audio reference generator; SD4110 digital video DA; enVY router control system, NT-based provides customized interfaces; 530-265-1010; fax 530-265-1000; www.nvision1.com

Circle (488) on Free Info Card



MATRIX SWITCHERS

Extron CrossPoint 1616 series: these RGBS/RGBHV 16x16 matrix switchers deliver 200MHz (-3dB) video bandwidth when fully loaded; inputs and outputs are isolated and buffered, allowing any single input or combination of inputs to be switched to any outputs with virtually no crosstalk; two models switch RGBHV and two switch RGBS; two of the models include two-channel, stereo audio; 714-491-1500; 800-633-9876; fax 714-491-1517

Circle (491) on Free Info Card

VIDEO DISTRIBUTION AMPLIFIER

Kramer Electronics Improved BC-1015: a new and improved 1:5 video distribution amplifier with enhanced overall performance that provides for flexible and unique four-way video output processing; the BC-1015 features a video bandwidth that exceeds 300MHz, signal-to-noise ratio that exceeds 73dB, differential gain of 0.2% and a differential phase of 0.15°; these specifications allow this DA to accept most SDI and analog signals; 888-303-5600; kramerel@netvision.net.il

Circle (490) on Free Info Card

SIGNAL MANAGEMENT SYSTEM

Telect VersaFrame 2000 modules: new modules for the VersaFrame 2000, a modular frame for analog and digital audio and video signal management, dock within the Versa-Frame and include a YC (S-VHS) video distribution amplifier, a YC (S-VHS) 8x8 routing switcher and a video waveform/color bar generator with a built-in 4x1 routing switcher; the Mini VersaFrame for smaller routing and distribution applications is also available; 800-551-4567 or 509-926-6000; fax 509-926-8915; www.telect.com; getinfo@telect.com

Circle (492) on Free Info Card

BE FASTtrack

Okay, you've got three, maybe three and one-half days to cover more than 750,000 square feet of exhibition floor space, catch a couple of sessions and monitor about 150 things back home. You don't have time to waste wandering around looking for that key product on the show floor.

BE FASTtrack is the answer. To help you navigate the complex, confusing, not to mention huge exhibition, we've arranged the exhibitors first by equipment category, then sorted by booth number. So, once you know what type of equipment you need, FASTtrack will lead you to those companies that have that type of product.

To help you find those companies highlighting DTV products, we've listed many companies with an asterisk (*) next to their name. The asterisk is your signal that these companies have told us they'll be showing new DTV products. As you tour the exhibits, look for the red *Broadcast Engineering* stop signs that say, "Stop here for DTV products." That's where you're sure to find the latest in digital solutions.

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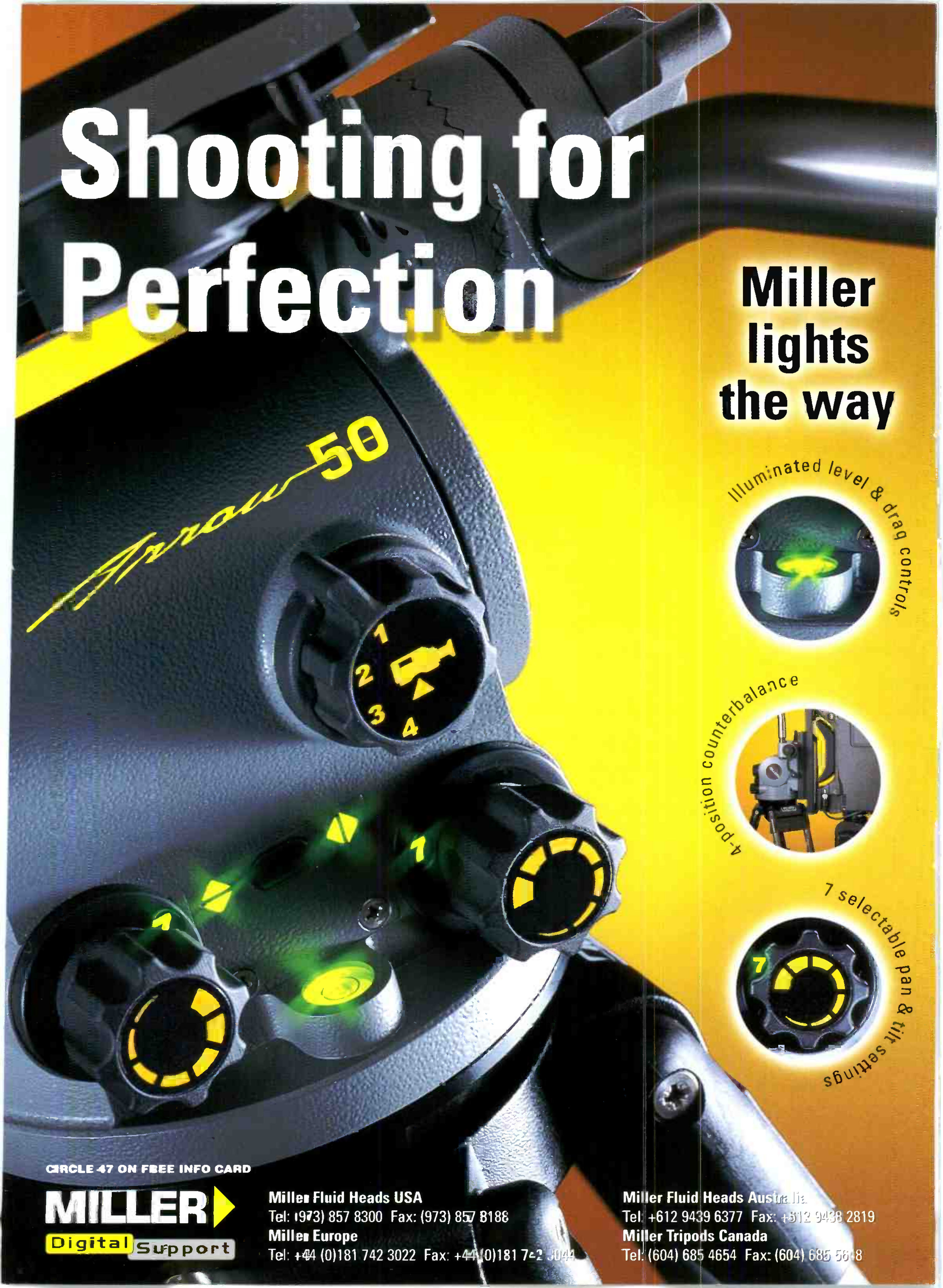

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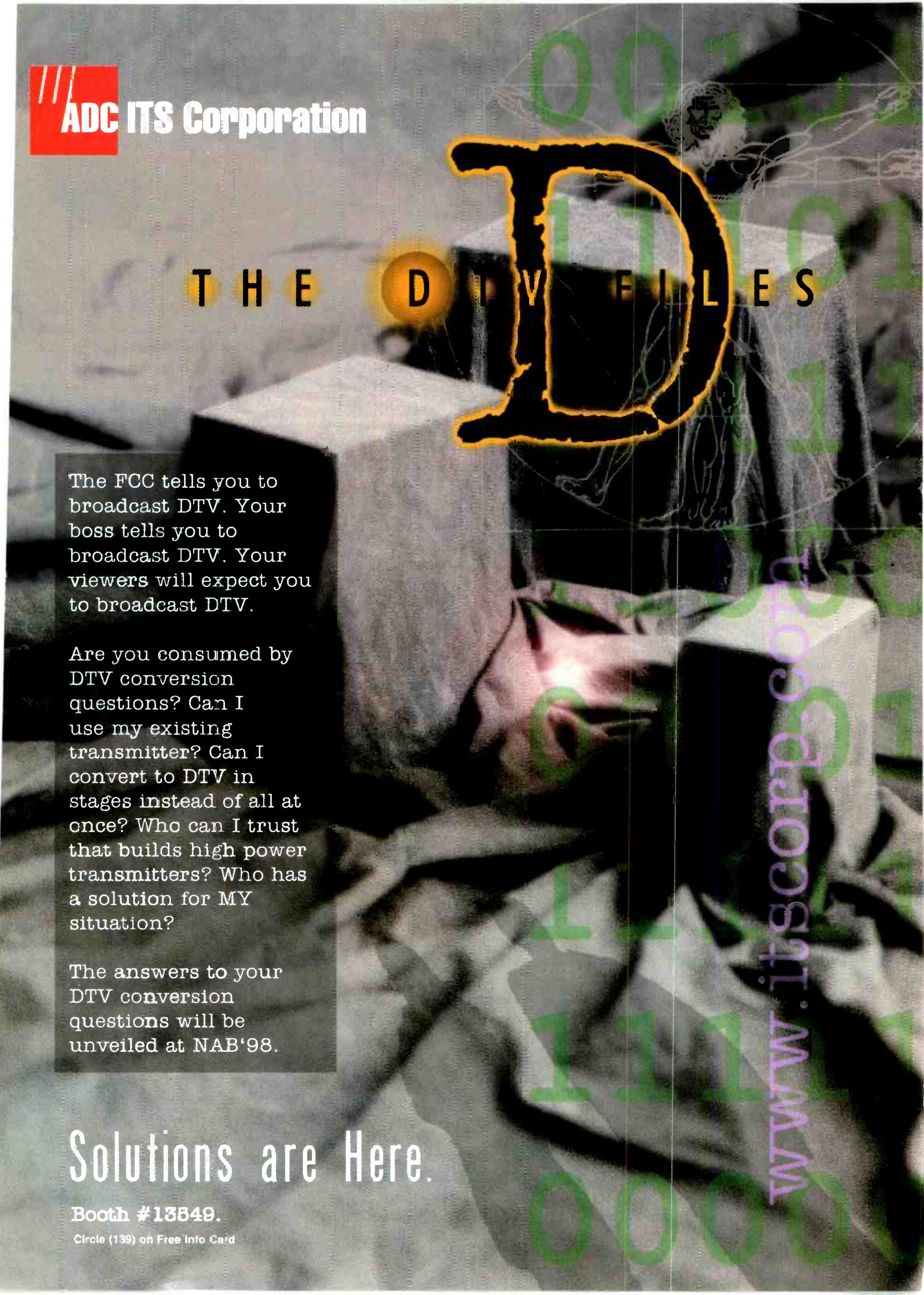
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Moving past procrastination

BY KARE ANDERSON

It's time once again to plan the budget for the station for the next year. You vowed not to put it off this year, but you're already facing an impossible deadline. Projecting annual expenses is not a job you look forward to, so you have put off many of the details till the last minute. You end up spending late nights going over past budgets, trying to establish baselines for the present budget, and stressful afternoons trying to predict maintenance and operating costs for the next year. After it's all done, you wonder why you ever put yourself through the headache of waiting till the last minute.

Minding the mind block

We all get mind blocks when facing certain tasks. Mind blocks have nothing to do with mental acuity. They're a part of the human experience for which many of us emotionally flagellate ourselves, while still continuing to avoid the task, thus incurring double damage. We all get stuck on different kinds of tasks. My blocks are with large-scale projects or boring tasks. You may avoid a technically tedious job or a project that's not in your area of broadcast interest. We procrastinate for many reasons, including feeling inadequate, bored, resentful or overwhelmed. Regardless of the reason, our procrastination behaviors are similar. They are variations on the theme of avoidance.

To learn about your avoidance pattern, jot down the top 10 essential tasks for your job, then check off the ones you always do first. Then star the tasks you put off. Keep one of those tasks that you always put off in mind as you read the following tricks to avoid procrastination and even find ways to savor completion of the task.

Contrasting scenarios

Picture the worst- and best-case situations for not starting an important task now. How bad will be the consequences if you don't get it done or get it done right? How exciting could it be if you did the task on time and did it superbly? What if you intend to start the task later today? How many things beyond your control can prevent you from getting started? If you start the task right now, when is the soonest you might be done if you get clear and focused and allow no other interruptions until you complete the task?

See your success again and again

Because many broadcast engineers are pressed for time, savoring each completed task can be satisfying. Just as athletes learn new habits to improve their performance by watching videos of master athletes, then store up memories of those images of successful workouts for their internal playback, your memories of a completed task can motivate you to have those satisfying experiences more often. You are literally seeing yourself repeat your performance, which is habit-forming. You will be more inclined to dive in early and get more tasks completed knowing a sense of satisfaction and a job well done.

Take on a big task a bite at a time

Taking on large or unfamiliar tasks where you don't feel confident about your performance are the ones you're most likely to avoid. On such a task, write down the steps needed to complete it. Call this approach "going slow to go faster later." Writing down the steps will make them more real and doable to you and your commitment to the timetable you attach to each task becomes more vital. Post your "tasks and timetable" where you can see it. Tell others of your commitment to that sheet. These actions will place the task higher in your consciousness.

Reward yourself

Plan your rewards ahead of time. Diligent engineer that you are, don't deny yourself the reward when you are done by rushing onto the next task. For example, when I complete a boring task, I allow myself a break, however brief, to signal the end of the task and celebrate, even if it's only a stretch break for movement and a change of scenery or a conversation about something other than the task at hand. When you finish a bigger task, give yourself a bigger reward.

Get into motion

Sometimes, facing a task straight on makes you freeze. Picture how to do the task by "sidelong glancing," that is, getting small glimpses out of the corner of your mental eye about how you can most easily do the task. One of the best ways is to get moving. In times of mind blocks, anger or tension, men tend to act out while women tend to shut down, moving less. You will be more aware of your emotions and motivations when you get into motion. Consider walking, eating or otherwise being "on your way" to doing the task. You will let your mind go free to see a way to get started.

When you are in motion and not focusing directly on what you have to do, you can see farther, gain a larger perspective and see how the parts of the task can fit together. You will pull up ideas from lower in your consciousness, think of apparently unrelated ideas that do have a bearing on ways to get the task done. Your unconscious mind becomes your friend in helping you recognize your best path to accomplishing the task. And, the task will seem less onerous because you lift your mood when you put yourself in motion. ■

Kare Anderson is a speaker and author. Visit her web site at www.sayitbetter.com.


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Transmission & Distribution

DTV interference

BY DON MARKLEY

It has long been the opinion of this writer that our industry will rise to meet any problem that we run into — probably. To date, there has been a great deal of concern about the possibility of interference between NTSC and DTV stations operating on first-adjacent channels. Now, it appears parts of that problem are rapidly going away.

First, the problem of a DTV channel on the first channel above an NTSC channel has not been solved (yet). At least four manufacturers are working on the problem and it may well be solved within the reasonable future. However, it appears that some manufacturers have a good handle on the n-1 problem where the DTV channel is on the first channel below the NTSC station.

Harris discussed its combining system at the recent DTV conference in Chicago. It has gathered a great deal of data on that system and feels that it promises acceptable performance. With regard to Harris' system, contact Bob Plonka at Harris (**www.broadcast.harris.com/dtv/**). He can furnish you with detailed measurements showing the system performance.

Just in the office is a paper from Micro Communications Inc. (MCI) discussing its proposed combiner. For information, contact Paul Smith at MCI and ask for report No. 6156. The report offers great promise with regard to system performance on adjacent channels, interference and group delay.

Unfiltered DTV spill-over

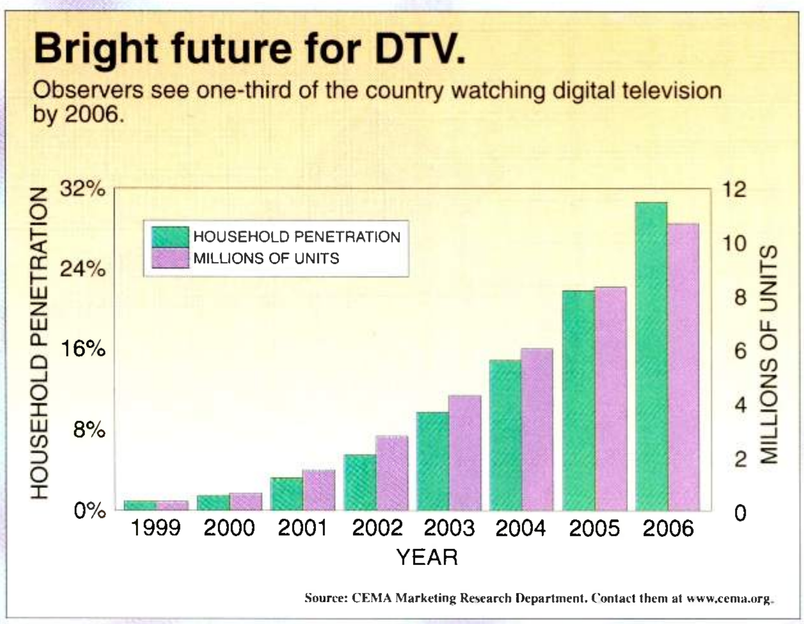
One of the big worries has been unfiltered DTV spill-over into the NTSC channel. When analyzed with the appropriate weighting function, the possibility exists that the weighted noise would be above the threshold of visibility in the NTSC signal. Not good. However, the filters proposed by MCI further reduce the DTV spill-over to 42dB below the threshold of visibility. This serves the problem of interference in the main lobe and of interference due to the difference in the shape of the main and minor lobes below the main lobe.

The concern has existed that interference between the channels would occur near the transmitter site and under the main lobe. This is a real worry for those stations using separate antennas where their site is in or near densely populated areas, particularly when the tower is tall. Many broadcasters would prefer to use a relatively low gain antenna for DTV, benefiting from the solid signal obtained from the combination of low antenna gain and high transmitter power. The worry is that the DTV signal will be significantly stronger in the nulls of the NTSC antenna, contributing to interference into the NTSC signal, which will still be the money-maker for several years to come.

The obvious solution is to use the same antenna for both signals. That would be a real leg up on the problem; unfortunately, the vertical pattern will not be exactly the same for both channels. Using a combiner with adequate filtering, such as proposed by MCI, would appear to eliminate that problem. If the signal strength at angles below the main lobe varies by as much as the 42dB margin the combiner would offer, the station has problems that call for immediate action. Moreover, the bandpass filtering ability of the system could be used to add that 42dB of additional protection where separate antennas are used — the case for many stations. One more problem causing worry to broadcasters has now been eliminated.

Next, the concern has existed that the

FRAME GRAB
A look at the consumer side of DTV.



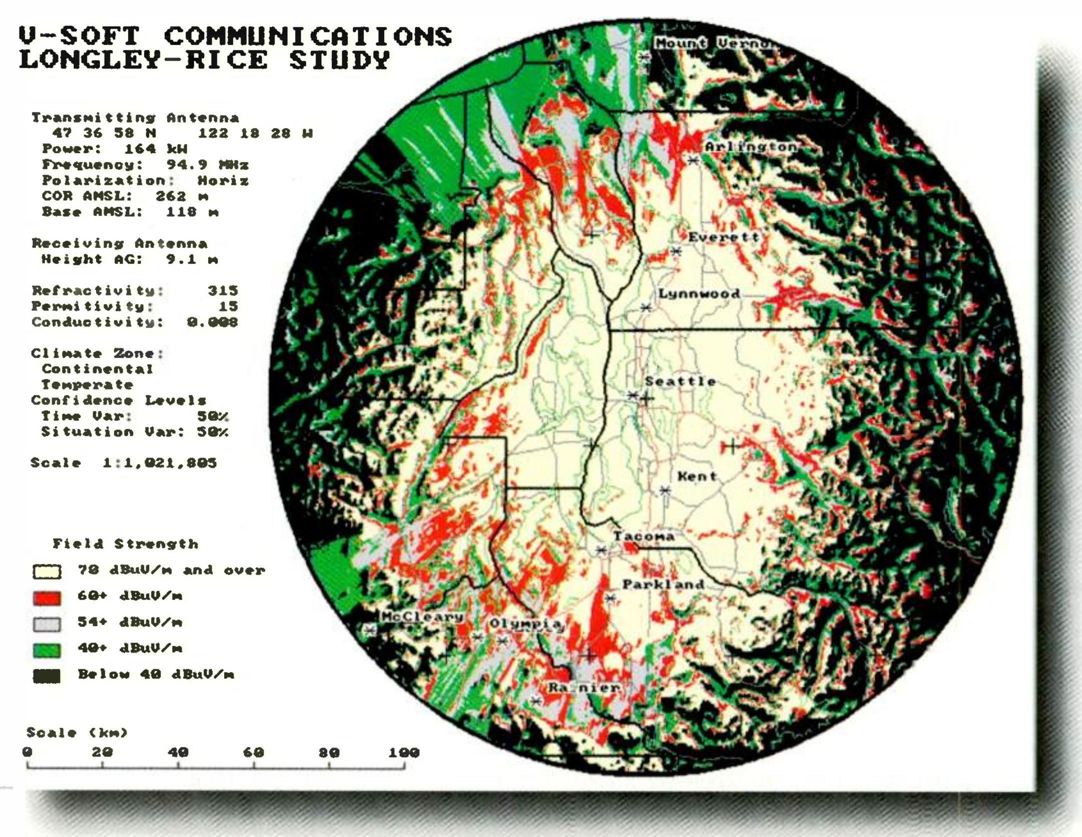


Figure 1. Several new software-based tools have been developed to help broadcasters predict coverage patterns. An example of a Longley-Rice study by V-Soft is shown above.

additional group delay caused by the insertion of such a combiner or filters may be beyond the capability of some transmitters to correct. The same MCI paper discusses the availability of using a high-power group delay equalizer. MCI points out that these devices are commonly used in other services and that they should be capable of correcting that amount of group delay that might be in excess of the transmitter correction circuitry.

Final DTV allotment tables

Something else has just been announced, although the complete document is not available as of this writing. In Report ET 98-2, released on Feb. 18, 1998, the commission adopted the final DTV allotment table, pending further revisions and further refined the DTV policies and rules. The initial document with the new DTV allocation table is available through the commission's web site. (See "News Flash.")

In the new release, the commission stated that it had tightened the technical rules that limit out-of-band emissions. This would further serve to reduce interference between DTV and NTSC stations. Check the web site periodically to obtain the latest version of the amended rules as modified pending another rash of petitions for reconsideration and further amendment, etc., etc., etc.

The report also addressed a number of procedural issues that should speed up the processing of DTV applications. The changes also permit some increase in facilities in excess of the basic assignments based on interference studies to other stations. This would appear to be a highly desirable change and should significantly speed up the application process. The commission says further rulemakings will address the issue of local and state zoning problems causing delay in the DTV build-out. That is great news for many stations that have been facing almost impossible difficulties in obtaining permission for a new tower.

Once again, problems have been identified in the proposed DTV service. Our industry is meeting the challenge of those problems in a timely fashion aided by the commission as needed rule changes are made. It is fashionable to pick on the commission as has even occurred in these pages. (Just tongue-in-cheek fellows, we don't really mean it.) However, the point is that the commission does listen to input from industry professionals representing the stations and manufacturers. It does respond when necessary to eliminate problems as much as possible. The engineers at the commission have faced an extremely daunting problem in developing the allotment table and in proposing the necessary rules to make the new medium work. Just once, let's acknowledge that work. Now, I have this little petition for reconsideration that I would like for them to look at before the new millennium! ■

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

News FLASH

Just before press time, the FCC released the long-awaited list of DTV channel and power allocations. For complete background on the commission's actions, see "Beyond the Headlines," p. 23. For a complete list of the FCC's allocations, check out its web site at: **www.fcc.gov/oet/dtv**.

Digital audio recorders

BY KENNETH HUNOLD

Digital processing has spread throughout the broadcast and production industries like wildfire. It is often forgotten that digital recording was perhaps the first application of digital technology that most broadcast engineers encountered. Digital recording was the first time that the recording process was separated from the production process. Until digital recording was introduced, the analog recorder was an integral part of the creative process. The sound of the tape was part of the sound of the performance. Once A/D and D/A converters advanced to the point of sonic neutrality (some would argue that it may still never happen) you could treat the recording medium as just a mirror of the original program material. Many forms of digital storage have evolved into useful production tools in today's broadcast and production studios. Let's look at a few of them.

Different shapes and sizes

The RDAT format (rotary-head digital audio tape — often shortened to just DAT) was originally conceived as a consumer format. The small size of the media could serve as a replacement for, and enhancement to, the open-reel recorder or even the cassette recorder. Perhaps, for political reasons more than technical reasons regarding recording and copyrights, its original market as a consumer format failed to materialize. It did find a home in the professional market as a popular, compact acquisition and mastering recorder for broadcasters. Portable field recorders, as well as rack-mounted studio record and playback devices have been developed for these markets. They are beginning to overtake the analog reel-to-reel formats in most applications. The DAT format records two channels of 16-bit audio on a 3.8mm tape. Often, 18- or 20-bit converters are used in these machines, but it is important to remember that the format only records 16 of those bits at common sampling rates of 44.1kHz, 48kHz and sometimes 32kHz.

The eight-channel digital recorders have been developed for two popular consumer videotape formats. These formats have found use in personal projects and commercial recording studios as inexpensive alternatives to the 24/48 channel professional recorders. Digital tape recording system (DTRS) recorders store eight channels of 16-bit audio on an 8mm Hi-8 video cassette. Sampling rates are commonly 44.1kHz and 48kHz. Multiple eight-channel units can be combined to effectively become a single 128-track recorder. Audio I/O is primarily analog, but some manufacturers have developed proprietary optical multichannel interfaces. The ADAT format also records eight channels of 16-bit audio, but these recorders use ½-inch SuperVHS tape as the recording medium. Most of the operational performance issues, including the stacking of units to increase track count, are similar to the DTRS format. Recently, an enhancement to the standard called ADAT-2 was developed. ADAT-2 allows 20-bit audio data to be recorded onto the S-VHS tape. Built-in A/D and D/A converters can be used or external digital I/O can be used. A whole cottage industry has devel-

DAT recorders, like this Otari DTR-8S, record two channels of audio with such flexibility and high quality, that they are often used to replace reel-to-reel decks.

Providing up to eight tracks of audio on removable MO disks, digital recorders like this Genex GX8000 can serve as a true replacement for the traditional multitrack reel recorder.

oped to provide third-party solutions to many interface questions and problems with these formats.

Another format originally developed for consumer use, but which has found a home in the radio, TV and theatrical industries is the MiniDisc recorder/player. The MiniDisc shares many similarities with the compact disc, including 74-minute play/record time and a similar laser pickup device. A major difference, aside from the ability to record, is that the MiniDisc uses data compression to reduce the amount of data recorded onto the magneto-optical (MO) disk. MiniDisc uses adaptive transform acoustic coding (ATRAC) to reduce the data to about 20% of its original size. Because the disc has the same recording density and track speed as a CD, this means the system only needs to read or write about one quarter of the time. During the other three-quarters of the time the pick-up is free to re-position itself to read or write audio data that has been scattered across the disk by previous erasing or editing.

This is similar to the fragmented computer hard disk. A MiniDisc player typically comes with enough internal memory to store a few seconds of audio and this buffer could be used to ride out mechanical shocks that knock the pick-up off-track. These gaps in the data would not be noticed in the audio output as long as the pick-up re-positioned itself before the buffer ran dry. The ATRAC compression algorithm has improved since its introduction, and this development will no doubt continue improving the sonic performance of the format.

Often, it is the software that creates the distinction between recorders and not the hardware itself.

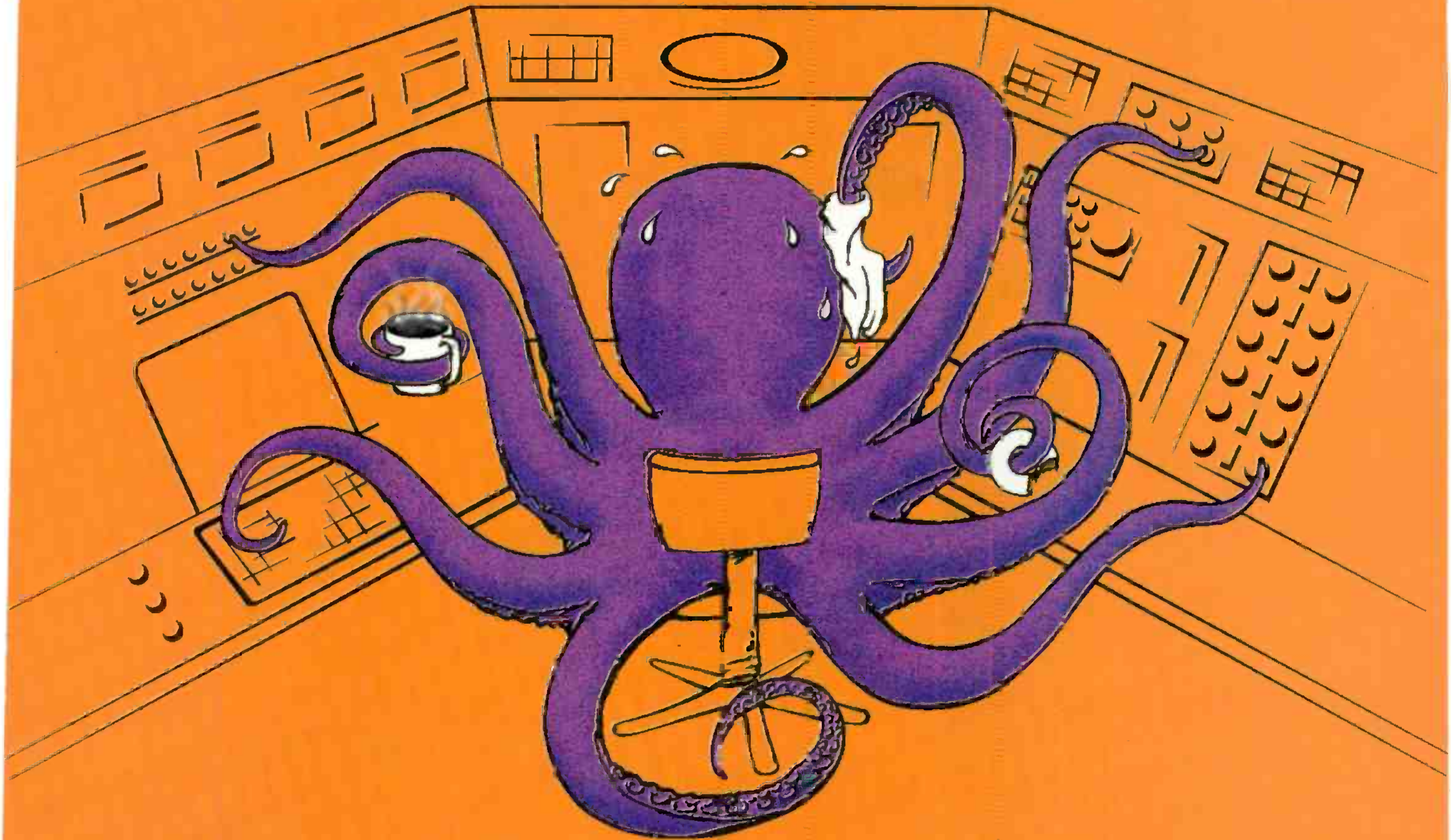
There are many hard disk-based audio recording systems available today. These systems run the gamut from digital recorder to digital audio workstation. This implies that the workstation can record, edit and playback audio data, sometimes simultaneously. These recorders use either conventional computer hard drives, portable PCMCIA memory cards or a combination of each. Uses for these systems range from cart machine replacements to networked sound effects devices with access to dozens of clips at the press of a button. Hard-disk systems are the area where new, audiophile systems are first introduced. The new 24-bit/96kHz sampling rate systems are available on hard-disk recorders because tape-based models have not yet been standardized. Often, it is the software that creates the distinction between recorders and not the hardware itself.

The traditional top spot on the digital recorder food chain still belongs to the open-reel digital recorder. Popular versions of this genre include the Pro-Digi and Digital Audio Stationary Head (DASH) series. The Pro-Digi models are available in 16- and 32-track versions, while the DASH series is available in two-, 24- and 48-track versions. These formats are all 16-bit formats with standard sampling rates of 44.1kHz and 48kHz. Recently, a new enhancement to the DASH series was introduced. The latest version of the DASH series is capable of storing 24 bits of audio data on tape.

Although not a digital audio recorder in the traditional sense, the development of the recordable CD (CD-R) must be mentioned here. CD-R systems have become affordable by most production companies and broadcast stations. As a result, many stations are abandoning their own custom music and effects libraries. The musical design of many shows is now mastered to CD-R for playback to air.

There is a digital recorder for just about any recording chore and/or budget. The choice often comes down to operator or client preference and not the underlying technology or even audio quality. ■

Kenneth Hunold is an audio/video project engineer for the ABC Engineering Laboratory, New York.



DirecTV's Network Monitoring Center

SYSTEMS DESIGN SHOWCASE

WJXX: *Surviving the digital revolution*

By Lee Ann DeForest

WJXX: Surviving the digital revolution

View of front of building exterior/main entrance, northeast view.

Digital technology is ushering in the TV industry's greatest changes since the addition of color in the 1950s. The switch from analog to digital has prompted numerous debates and even more questions, while the FCC's deliberate hands-off approach has provided few answers. As stations across the country prepare to meet deadlines, the key to successfully surviving the digital revolution is adaptability.

Adaptability drove the design and construction of WJXX-TV in Jacksonville, FL. Allbritton Communications of Washington, DC, commissioned Rees Associates Inc. to develop a fully digital station with an eye toward the uncertain future standards of the industry. The result was a new 27,500-square-foot facility that reflects the latest state-of-the-art broadcast and construction technology and maintains future-friendly capabilities to grow and change with the industry.

Early planning for the $7 million project began several years prior to developing the actual design. While the FCC digital conversion deadline of 2006 already had station management examining possible alternatives, WJXX was motivated by a different concern. WBSG, Allbritton's original facility in this market, is located in Brunswick, GA, 60 miles north of Jacksonville. Although this is still within the Jacksonville metro, Allbritton officials wished to improve ratings and advertising income by moving to the heart of the market. This long-time wish, coupled with the FCC mandate, meant that the time to expand was now.

Following this decision, Allbritton officials needed to select a location for the future WJXX. The city of Jacksonville, currently one of the faster growing and more popular cities in the United States, posed a challenge for project construction. This immense growth meant an explosion in construction and development. The suburban site had the construction team facing a shortage of available workers due to nearby construction of three separate hotels.

After isolating the well-traveled J.T. Butler Boulevard corridor, a few months were spent picking the site that would fit the building and parking requirements while still maintaining visibility from the highway. The chosen property is an even plane, while a rise in the road will allow the boulevard's estimated 300,000 travelers a day to view the new, modern station as they pass by the site.

As with many similar projects, tight scheduling posed the biggest challenge for Allbritton and

Rees. With groundbreaking to begin in April, 1997, and completion set for mid-December, planning and scheduling were crucial to success. Rees, a Dallas-based architecture, interiors and facilities planning firm, provided the design and architectural services for the project. The company had established a relationship with Allbritton in 1989 while handling the reconstruction of Charleston's WCIV following damage from Hurricane Hugo. Having designed more than 150 broadcast facilities worldwide, including prior work in Jacksonville, Rees had also just completed work on the design and construction of Allbritton's WBMA in Birmingham, AL, in September of 1996.

To help meet the eight-month deadline, Rees brought the entire Birmingham team to Jacksonville, including everyone from the contractor to the set designers to the equipment and furniture suppliers. The team brought valuable experience building a digital station, with all of the various electrical and technical considerations. This knowledge, not always available in a given market, was critical to helping WJXX meet its time line and budget.

The general contractor, Brasfield and Gorrie of Birmingham, developed a four-stage project schedule. Sequence one involved construction of the 100-foot microwave and clock tower, while sequence two developed the administrative areas. Sequence three created the station's "heart and soul," the technical operations (tech ops) center, followed by the building of the studio, newsroom, mezzanine and prop shop in sequence four.

These four stages were developed to address the availability of materials. Efforts to use materials indigenous to the area complicated scheduling. A lead time of 12 weeks on the most critical item, structural steel, dominated most timing concerns. While presenting a lesser scheduling problem, mechanical air-handling equipment also required a 12-week lead time. The remaining materials were relatively easy to obtain.

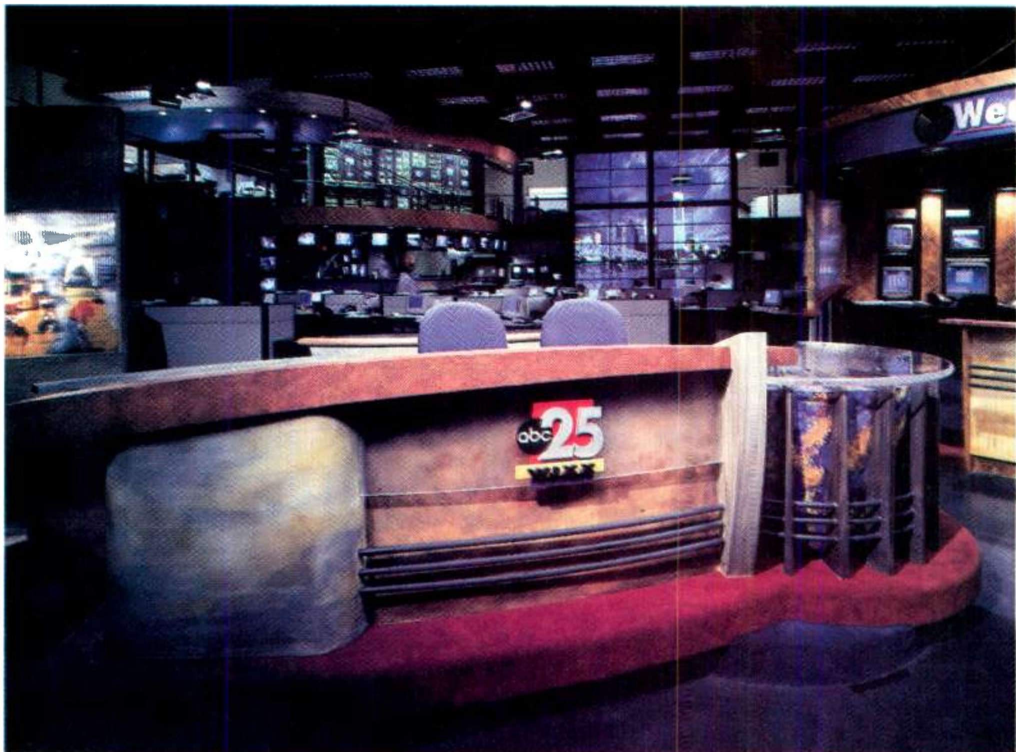
Building in Jacksonville required strict adherence to hurricane-safe guidelines. The facility must be able to sustain winds in excess of 100 miles per hour. The building also had to be designed such that if exterior walls are blown out the structure remains in place. These codes necessitated greater planning and the creation of more structural supports for the station.

The site is surrounded by wetlands on two sides. Storm water runoff is a big concern in Jacksonville because groundwater is only 18 to 24 inches below the surface. Working with input from local government officials, Rees' planners created a nearby retention pond to absorb runoff from the site.

The architect then set to the task of designing an eye-catching, yet adaptable facility that would blend into its local surroundings. Because Jacksonville is a coastal city, Rees felt it was important to use creative ways to express a wharf and industrial motif with a Floridian feel. Keeping in mind that WJXX plans on a long future for the facility, it was designed to change with the times, technology and the industry.

In keeping with that philosophy, the exterior of the building is a composition of contrasting size, texture and color. Materials were chosen that would symbolize the broadcast communications process. For the designers, the rough gray-white stone represents the research, editing and production of news while the smooth black, horizontal bands that envelop the building, along with metal x-bracing ties, bind the building together representing programming and news ready for distribution.

The 100-foot microwave and clock tower is perhaps the most distinctive external feature of the facility. This monolithic structure stands adjacent to the station. The tower has four eight-foot-diameter clocks, backlit on each side of the tower. In a backlash over too many cell phone towers, the Jacksonville metro government has issued regulations limiting structural height to a



View of news desk looking into newsroom in the background.

maximum of 100 feet. Because this height was necessary for broadcast, WJXX officials worked with the city to ensure its standard would be met.

Numerous features from the outside were brought inside to unify the building's look. Almost everything throughout the facility's structure is exposed, from x-bracings to ductwork. The cable trays are open and visible throughout the building, with cable literally tying all of the areas together. While hurricane zone requirements demand more structure, nothing on this building is ornamental.

It has a fairly primitive design, which is important for broadcast facilities, where access is key. Engineers are also able to get to the equipment easily with the simple, yet highly functional design.

In planning the interior layout of the station, Rees referred to plans from the past. Because Allbritton sees the focus of WJXX to be the creation of one essential local product, the news, Rees suggested building only one studio within the station. The company chose to adapt the plans it had originally used in 1989 in Charleston for several reasons. The design had proven itself workable and efficient in the last eight years and, by keeping the same overall plan, the team was able to shave time off the front-end of the design process.

WJXX's layout creates a compact facility while providing room for extra space and future growth. The tech ops area is in the center of the facility, with all other areas providing support. The open setup not only allows for easy access, but it also allows for greater air circulation to aid in cooling of the tech ops equipment. The layout also facilitates tours, giving visitors a view of the entire operation without interrupting daily business. The sales and administrative areas will receive more visitors and are found at the front of the station, while news is kept away from the front door, with activity primarily among employees.

News is the sole product and its production the central operation. In designing only one studio, Rees also bucked tradition by making this studio highly informal. Rather than setting up anchor desks and sets, the newsroom has sets within itself from which to report stories. The newsroom, containing all of the workstations and equipment, becomes the set, keeping the focus on the process and product of news gathering. The room is designed, however, so that if a more traditional set is merited, a separation wall can be constructed without impacting wiring or space.

As a result of this layout, background sound within the newsroom became a concern. Sound attenuation was the desired effect, but unlike some stations, WJXX was not concerned with achieving pristine, acoustically dead spaces. Station executives believe that during broadcasts from the newsroom, the viewer understands that there must be background noise and activity. This activity has, however, been prevented from ever becoming a distraction.

The master control room.

Sound-attenuating batts were used within the walls and certain ceilings. The news studio was designed with a sound-isolating system of dry wall and black sound blankets from floor to a height of 16 feet. Edit bays are also encapsulated with the same sound-reduction walls and ceilings.

Although the primary design goal was to remain future-friendly to digital technology, a secondary goal was to give the newsroom a larger feel on television, such as that of a station in a larger market.

Choosing the right equipment

Stations across the country are making decisions regarding their future broadcast equipment and signals without knowing what industry standards will be. WJXX, too, made educated guesses into the equipment it will need to thrive into the next century.

Harris Allied of Kentucky provided system integration guidance for the project. Within the tech ops lies the Saturn master control, supported by a Venus 96x96 router capable of handling digital video, analog video and analog audio. An Enco DAD audio file server is operated through a Wheatstone TV 600 audio console. WJXX selected a Media Pool four-channel file server for commercials, controlled by an Alamar automation system. Ikegami monitoring is used throughout the facility.

All tape is digital, using DVCPRO videotape recorders, with Leitch synchronizing, digital and analog distribution and digital conversion equipment. To produce newscasts, Harris selected a DD-30 production switcher, which brings in elements such as live feeds and taped segments provided by the Scitex DVEous digital video editing system. Broadcast animation is provided by Chyron Max and Maxine character generators, with sound support developed by Videotek digital processing amplifiers.

View of newsroom from mezzanine level.

Station officials chose LDK-100 cameras for the studio, employing TSM camera robotics to control movement, while LDK-700 cameras are used out in the field. Remote broadcasts and feeds are handled by a Microwave Radio Corporation/Troll Technology microwave system, operating on 2GHz, 7GHz and 12GHz bands. Although WJXX currently broadcasts an analog signal, all of this equipment is in place and is readily convertible to a digital format.

The conversion from an analog to a digital signal has made the TV industry a hotbed of change. Rather than waiting to see how the usage and standards of digital technology evolve, Allbritton met the future head-on using the latest state-of-the-art equipment and expertise. In eight months the WJXX project team designed and constructed a fully digital station in the heart of the Jacksonville market.

While maintaining the focus on the station's chief product, news, Allbritton and Rees developed a station that is capable of growing with the industry. With such an unpredictable and uncertain future, not everyone may survive the digital revolution. Those that thrive will do so based on their ability to adapt to change. WJXX is, and will continue to be, a success story as a result of Allbritton and Rees' educated choices made with an eye toward the future of DTV. ■

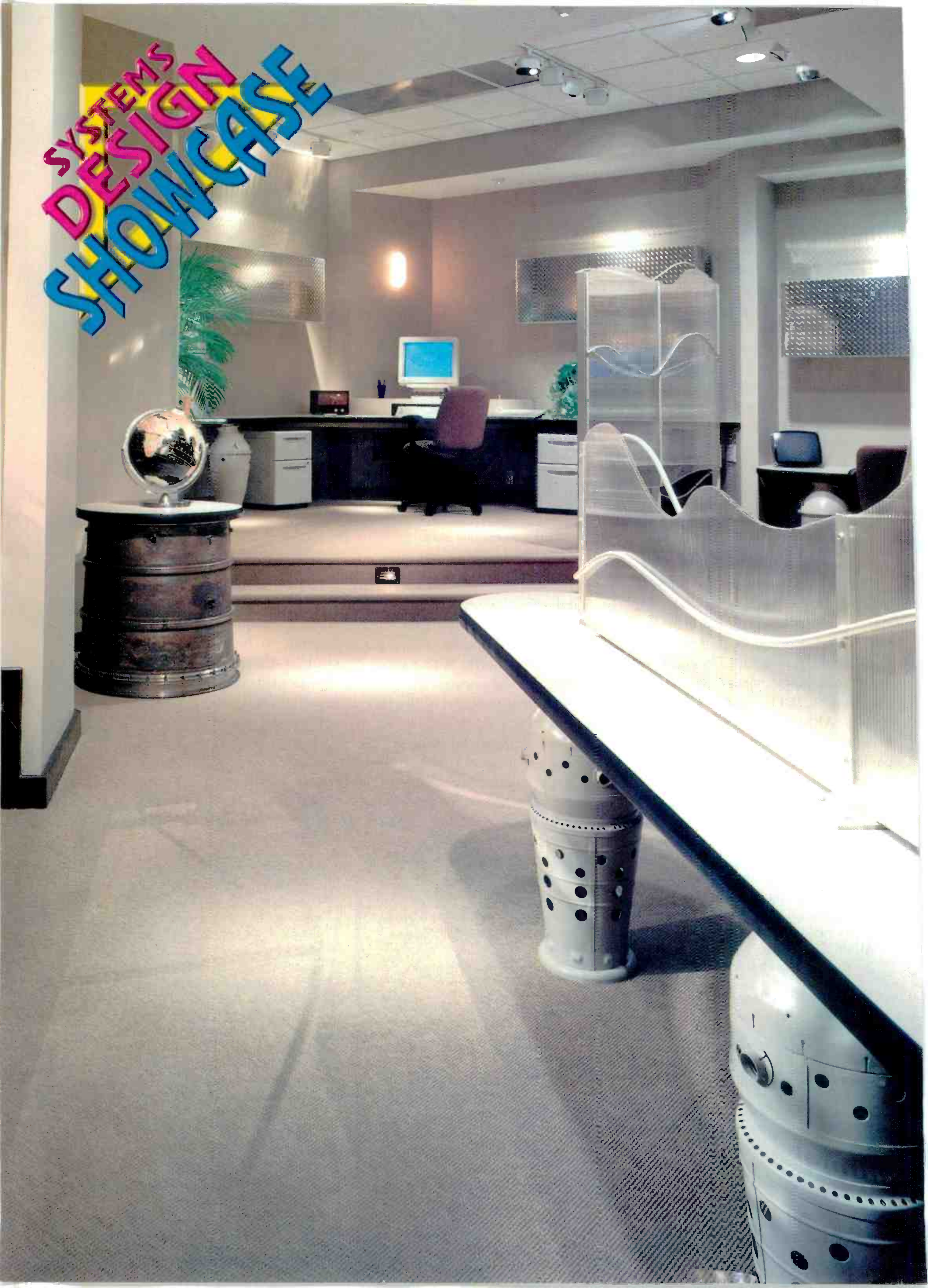
Lee Ann DeForest is a technical writer for Rees Associates, Oklahoma City, OK.

Design Team:

Client: John Hills, project manager, Allbritton Communications
Architect: Ralph S. Blackman, vice president and project director; Trey Lucas, project coordinator; David Evans, project coordinator, Rees Associates
M/E/P Consultant: Bill McPherson, project manager; Chris Pebbles, electrical; Johnny Brown, electrical; Mike Sawyer, electrical; Brian Hess, mechanical, Hibble Peters and Dawson
Structural Consultant: Ken Elkins, project manager, ProDeCon
Broadcast Systems Consultant: Jay Adrick, Harris Allied
Set Designer: Dan Devlin, Devlin Design Group
Lighting and Rigging Consultant: Bill Capps, senior systems designer, Barbizon Light
Civil/Landscape Consultant: Autry Allen, project manager, Robert M. Angas Associates
Landscape Architecture: Carol Worsham, Landers-Atkins Planners, Inc.
Furniture: Skip Fike, Solutions and Resources
Contractor: J.H. Lott, project director; Hal Lassen, project manager; Steve Harbison, superintendent; Brasfield & Gorrie

Equipment List

Scitex DVEous DVE; Alamar automation system; Leitch synchronizing equipment, digital and analog distribution, digital conversion equipment and clock systems; Ikegami monitoring; Chyron Max and Maxine character generators; Videotek digital processing amplifiers; Vinten camera robotics; Clear-Com Matrix II intercom; Wheatstone TV600 audio console; Enco DAD audio file server; Microwave Radio Corporation/Troll Technology microwave system; Philips products: Saturn master control; Venus 96x95 router; DVCPRO videotape recorders; Media Pool four-channel file server; LDK-100 cameras; LDK-700 cameras; DD-30 production switcher.


SYSTEMS
DESIGN
SHOWCASE

Crawford Digital and the FilmGroup:

Setting the new standard for HD production

By Charles Eaton

Technological advances in digital television, audio and film production and distribution are rapidly changing the way we do our jobs. Add to this the ever-changing needs of clients for higher quality, bolder images and graphics and it's easy to understand why we are in the race of our careers.

Recognizing changes in the industry and in clients' needs, the Crawford Communications management team set out to build a leading-edge facility, prepared for whatever format was in demand. More than seven years ago we began to map out a vision for Crawford Digital and the FilmGroup — adjoining facilities that would combine our engineering and operational knowledge with a creative and friendly environment. We knew that to succeed we had to commit to taking risks, investing early, testing new products with hardware and software manufacturers and retraining our team on the new technologies. Now, Crawford Digital and the FilmGroup offer the latest in standard-definition 601 component digital equipment, and also all of the necessary elements to launch into high-definition formats.

The recent openings of Crawford Digital and the FilmGroup represent our initiative to make the total process, from film transfer to production and distribution, more creative, technically integrated and user-friendly. Crawford Digital was designed to adapt to any format or line resolution in support of the new digital TV standards. We believe it is a powerful advanced imaging and editorial facility.

Today, Crawford has the ability to transfer film images from the FilmGroup as large digital files from the Spirit Datacine, to editing/compositing suites like our new Discreet Logic Inferno to computer animation workstations. We are already capable of outputting a digital high-definition 1,080i film

Photo: The 3-D suite is based on an Alias/Wavefront Composer with Power Animator and Lightwave 3-D software.

Crawford Digital and the FilmGroup:

Setting the new standard for HD production

transfer in real time to an HD Panasonic D-5 tape machine. We are now designing and installing the infrastructure to do direct non-real-time delivery to high-speed data recorders and disc arrays, such as the SGI ORIGIN 2000 server. Ultimately, we will be able to output to any format that is compatible with any television or new media standard.

The Philips Spirit Datacine was recently upgraded so it can output in real-time 4:4:4 resolution via an HIPPI interface at 600Mb/s.

By taking each of these steps, we have placed Crawford Digital and the FilmGroup at the forefront of creating the resolution-independent environment. We are also designing high-speed networking and archiving systems and data retrieval systems that will allow us to store the images for clients to use well into the future.

Glimpse of the future: HDTV in post

A moment of TV history transpired at the Crawford Digital open house in November 1997. Our guests experienced a working demonstration of HDTV in a post-production environment — a first outside industry trade shows. The demonstration, through the cooperation of Philips, Silicon Graphics, Discreet Logic, Panasonic and Sony, brought the future to Atlanta.

The HDTV state-of-the-art presentation showcased Crawford's commitment to HDTV production. Crawford's clients, suppliers and media from all over the country were shown an open resolution post-production environment capable of delivering a theatrical-quality image to the viewer. We explained how to work from film-originated material through to a final edited production that could be delivered to the viewer in any of the 18 advanced digital TV formats.

The demonstration was a prototype of post-production in the future since the HD editing tools are still being developed as the technology evolves. Clients were shown film transfer on the Spirit Datacine in two ways — first, in the HDTV format, which would go directly to a tape machine; second, as data into a Silicon Graphics computer. The HDTV signals were displayed on Panasonic and Sony monitors and recorded to Panasonic and Sony tape transports. The data went through a high-speed network (HIPPI) into a Silicon Graphics Onyx II supercomputer at the amazing rate of six frames per second. Editing and effects were accomplished using a pre-release high-definition version of Discreet Logic's Fire and the resolution-independent Inferno. Additional support for the demonstration was provided by AV Digital and Pluto Technologies. The Crawford Digital demonstration provided an opportunity for the industry to see just how Crawford Communications is gearing up, and how multiple resolution can be accomplished.

Our team and facility

To create the new open resolution facilities, FilmGroup director Craig Heyl and chief engineer David Warner teamed with Crawford Digital's chief engineer Trevor Mincher, visual effects supervisor Ron Heidt, and assistant chief engineer John Bradford. Additionally, we received exceptional engineering support from Discreet Logic and Philips. We brought in Crawford Digital's new

Crawford's SGI Onyx 2 was recently used to demonstrate film-to-HDTV translation into the computer over an HIPPI network at 6fps.


The equipment room showing the Quantel Henry V6, Sony Digital Beta and three Pluto Space recorders.

general manager, Chuck Brock, from Turner Broadcasting's Advanced Imaging Group. Crawford's management team led the strategic planning.

We also listened carefully to our clients in the design and development stages of this facility. It was suggested that we provide technical consultation, especially on the front end of the project to allow clients to make the most of new technology as cost-effectively as possible. It was also suggested that a creative environment is crucial. Consequently, we paid great attention to the atmosphere at Crawford Digital. We placed an emphasis on providing unique design and capabilities in every suite.

Crawford Digital offers five advanced 3-D computer animation workstations, three on-line component digital edit suites and three high-end digital compositing suites, all engineered in an open architecture to provide easy connectivity between the various suites and workstations.

Spirit Datacine

Early in 1997 Crawford Communications took delivery of an HD upgradable Philips Spirit Datacine, capable of delivering 2kx2k images, scanned by a one-line CCD array. We chose the Spirit as our gateway to HDTV, the centerpiece of our HD production path. The Datacine is equipped with the Super 35mm gate and Super 16mm gate, which will do the normal 35mm and 16mm formats, as well. The noiseless and rock-steady pictures are impressive. The optical quality, superb capstan servo and film-handling characteristics are unmatched.

In January, Crawford Communications upgraded the Spirit Datacine for HD output by purchasing the real-time 1,080i HD board and a data board, capable of outputting 4:4:4:4 resolution. At the present time it is connected via an HIPPI interface, which transfers data at around 600Mb/s. ■

Charles Eaton is vice president of engineering at Crawford Communications, Inc., Atlanta.

Design Team:
Client: Crawford Communications
Architect: Alex Munoz & Associates
Engineering: Charles Eaton, vice president of engineering, Crawford Communications; Trevor Mincher, chief engineer, Crawford Digital; John Bradford, assistant chief engineer, Crawford Digital; David Warner, chief engineer, FilmGroup
Consultation: Ron Heidt, visual effects supervisor, Crawford Digital
Designers: Jack Maloney, Crawford Communications; Matt Daly, Crawford Communications

Equipment List:
Non-linear suites: Discreet Logic Inferno; Discreet Logic Flame; Quantel Henry V6; *linear suites:* Accom Axial editor; Accom digital disk recorder; Pluto Space recorders; Ampex DCT; Sony Digital Betacam; D-1 tape machines; Graham Patten 400 or 800 audio consoles; Grass Valley Kaderza; SCITEX 8100 switcher; Grass Valley 2200 switcher; *3-D workstations:* All 3-D engines have access to Pluto Space Recorders and VTRs; *software:* Lightwave 3-D; Alias/Wavefront Power Animator; Alias/Wavefront Composer; Maya; *facility-wide* 128x128 serial digital router

SYSTEMS DESIGN SHOWCASE

Twin stations go digital

By Peter Grimm

Perhaps even more than the rest of the broadcast community, broadcast engineers often feel pressure to foresee the future. We know it is our responsibility to guide our stations and facilities toward the digital future — economically, as well as practically.

As NAB 1998 approaches, early forecasts are coming true. The pace of station transitions from analog to digital is clearly gaining speed. Market by market, broadcasters are finding that to remain commercially viable the solutions provided by digital technologies must be adapted.

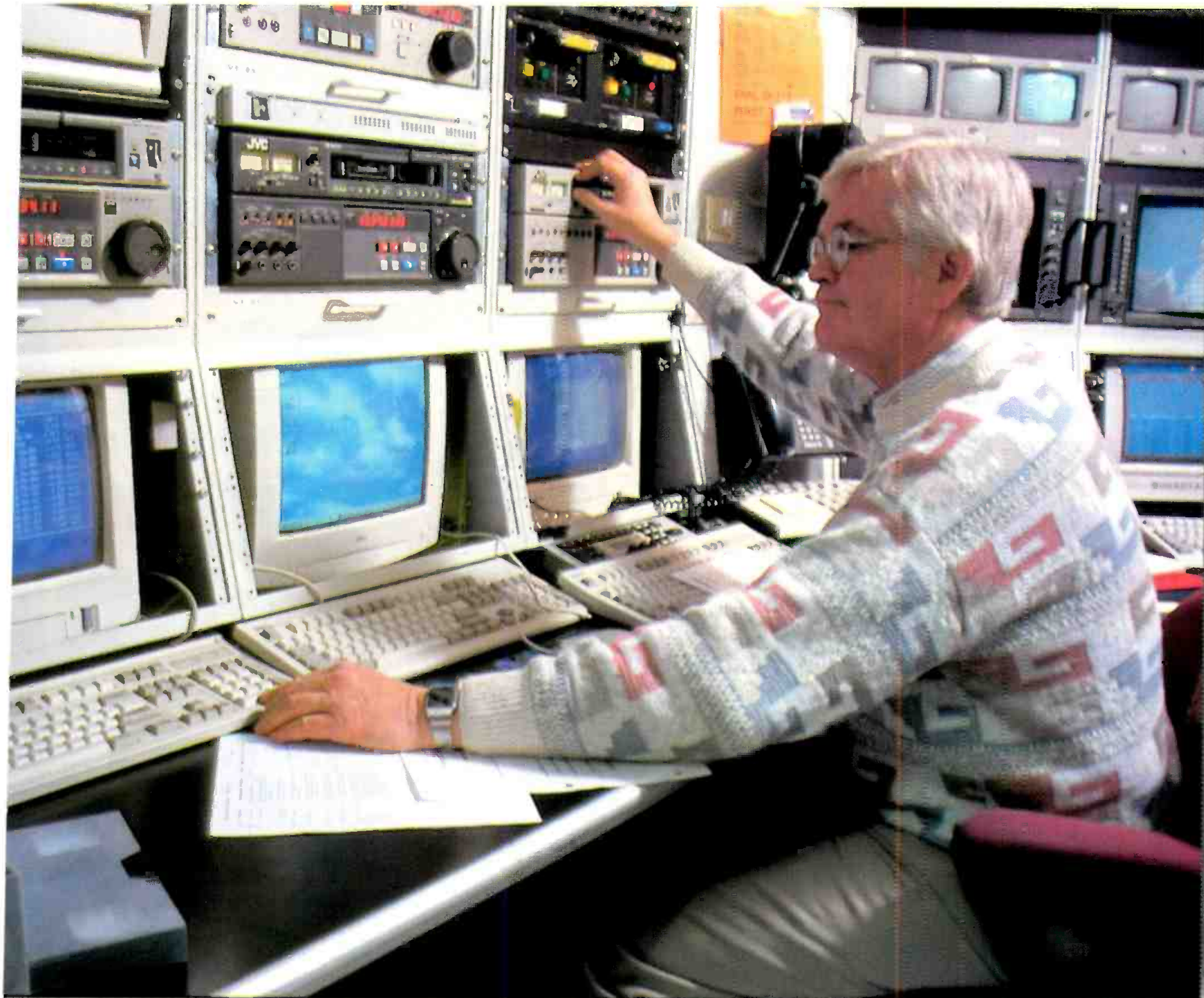
For us at KRXI, going "digital" was an easy business case to make. However, choosing the right format was another issue altogether.

Strategy for growth

The motivating force behind our decision to upgrade KRXI-TV, the FOX affiliate in Reno, came from new management. Cox Broadcasting bought KRXI and LMA'd with KAME with the goal of improving both stations' image and profitability.

In 1995, when Cox Broadcasting made the commitment to improve the sister station's technical strength and image, we knew that selecting the proper mix of digital technology had to make a strong business case, but also would serve the station well as we moved to DTV.

In just two years, we changed from 3/4-inch to S-VHS, and finally last year, to JVC's 4:2:2 component digital format, Digital-S. In the process, we reshaped our programming, and have, in fact, become more competitive and more profitable.



Lead operator Gaylon Roe, in master control using a BR-D750s editing VTR. The station uses three of its four BR-D750s for production.

The two stations, KRXI and KAME, conveniently share space in downtown Reno. Their master control rooms operate side by side. KRXI-TV, Channel 11, a FOX affiliate, is owned by Cox Broadcasting outright. KAME-TV, Channel 21, a UPN affiliate, is managed by Cox Broadcasting and is owned by Broadcast Development Corporation. It is a delicate balance of competition and cooperation. Although both stations are in the same Reno market, they have vastly different audiences.

Management at Cox Broadcasting stipulated that upgrades at both stations be economical and of superior broadcast quality. Also, both stations were slated to go digital within a three-year period.

This deadline made my equipment list a hot topic. Also, renovating KRXI/KAME in tandem, instead of sequentially, made the financial and technical decisions doubly important. Selecting the right technology would place us ahead of the market and poised for strong growth. A wrong decision could be crippling.

The logical choice

There were many phases to our upgrade to digital. However, the choice of a digital videotape format was a core decision, upon which many other decisions hung. Once we really looked at our options and our budget, it was clear that JVC's Digital-S provided the best way for us to move toward the digital broadcasting future.

Upgrading to Digital-S

We were already standardized on S-VHS as a house format. As a primary format, S-VHS was economical and enabled us to quickly and easily build a professional quality videotape library. In retrospect, the selection of S-VHS was a critical factor. Also, our familiarity with S-VHS made the decision to move to digital via Digital-S smooth and economical.

One clear advantage for us was the format's backward compatibility with S-VHS. This allows us to still play our old tape stock while preserving our extensive S-VHS library.

Our station management was also impressed with the price and performance of Digital-S. I recommended the format for several reasons: it has extremely high-quality 4:2:2 component digital sampling, mild 3.3:1 compression and uses robust ½-inch tape. Competing DV formats use 4:1:1 sampling and 5:1 compression. Low compression ratio gives us

Twin stations go digital

images with terrific definition. And, because it's a digital format, there is no generation loss during editing or dubbing.

Our decision to adopt the Digital-S also provided KRXI with a high-quality 4:2:2 acquisition format to spool onto our non-linear editing system. Because most of our work is short-form editing, non-linear editing is playing a greater role than ever in our production. We consider the image quality provided by 4:2:2 sampling highly desirable if we're to maintain the quality once the material is downloaded into our video server. Also, the BR-D51 player has digital capability and S-VHS playback capability. The dual functionality of this machine and the overall robustness of the format made Digital-S a good choice for both stations.

Compatible upgrade

KRXI purchased four JVC Digital-S BR-D750 editing VTRs, three of which are used for production. We also purchased two JVC BR-D40 dockable recorders, which mate with our three JVC KY-27 cameras.

The new decks complement the station's 31 S-VHS machines and made the transition to digital more economical. And, with the resulting savings, we intend to accelerate the replacement of the remaining S-VHS machines with Digital-S decks, developing a complete digital production system from field to final edit. We feel that with the digital 4:2:2 format we get a quality level similar to that of a one-inch machine.

Other system upgrades

Our comprehensive renovation included a transition to the satellite commercial delivery service Cyclesat, now known as Vyvx. The Vyvx system lets KRXI and KAME receive, download and record commercial spots needed for air.

Previously, commercial download required recording feeds from Cyclesat onto the one-inch machine. Besides tying up our one-inch machine all night until the feeds came in, the taped commercials still had to be transferred into our video server for broadcast. Although the videotape quality was fine, the process was cumbersome.

In the editing room, Digital-S handles the tape duties supporting a Scitex Stratosphere non-linear editing system. The fan is for cooling the operator — not the equipment.

Because the Vyvx upgrade came with a new digital receiver, continuing to rely on a one-inch record deck no longer made any sense. This was the trigger for our move to Digital-S. We purchased our first BR-D750 editing recorder, making life simpler for our night shift operators while at the same time improving image quality.

The operators just load the BR-D750, make sure the switch is in nine-pin mode for remote control from the Vyvx receiver and the next morning the needed spots are on tape. The spots are then transferred to a Hewlett-Packard video server by the Louth automation system.

Like many stations, about 90% of

KRXI engineer Peter Grimm lives out his shooter's dream with the JVC Digital-S BR-D40 dockable recorder tied to a KY-27C camera.

the programming, especially during the day, comes from tape. We have three S-VHS machines in each master control where we record programs for later playback on S-VHS. While our primary on-air program format remains S-VHS, we will eventually switch over to Digital-S entirely.

Digital-S: Priced right

As I mentioned, costs and quality played a significant role in the rebuild of KAME and KRXI. We ruled out the DV formats because of their tape size and lower sampling rates. Although Digital-S is comparable to BetaSP in cost, it provides the advantages of digital recording. I believe that even to the experienced eye, there is no perceptible difference between one-inch and Digital-S. And, one-inch costs more.

We evaluated Digital-S side by side with one-inch, examining the signal on our scopes, and it looked as if the color bars were recorded by a color bar generator. This happy finding triggered many of us to co-opt the old Memorex commercial and say, "Is it live or is it Digital-S?" The image quality is impressive.

Once management agreed to adopt the Digital-S format, we found our equipment expenses were less than we had budgeted. And, as mentioned previously, this savings allowed us to do a more comprehensive upgrade without sacrificing quality or spending beyond our budget.

Of course, we still have BetaSP equipment because we still receive a lot of commercial production on BetaSP. We then dub the BetaSP tape onto our non-linear editor and then, instead of spooling it back out onto BetaSP, we spool it out on Digital-S. This gives us a 4:2:2 digital feed with virtually no degradation.

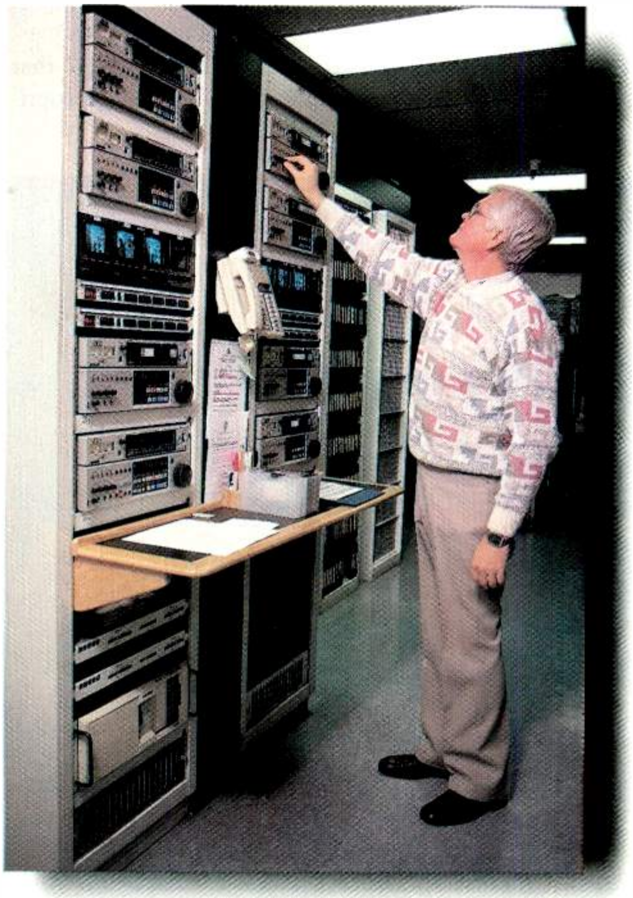
JVC's economical Digital-S VTRs have allowed KRXI to move away from the one-inch format and have kick started its station into the transition to digital.

Long-lasting heads

Both stations operate around the clock. And, from my engineering standpoint, repairing video equipment on air is analogous to working on an airplane while it is in flight. No matter how remote, there is always the potential danger of crashing mid-air. If we run into problems, we have to stay on the air and keep our broadcast signal live. Because of that, engineers demand reliable equipment. I have found that my JVC equipment — from S-VHS to Digital-S — is reliable and strong. These formats are popular because they perform under pressure and to the manufacturer's specifications.

During the research phase of our upgrade, I interviewed engineers across the United States for background information on equipment performance. FOX Broadcasting in New York City was an early adopter of Digital-S. In fact, it was the first large domestic sale for JVC — and they vouched for the format's quality and dependability.

Currently, their experience with the Digital-S tape heads shows a life of close to 3,000 hours. That is four times longer than the promised 750 hours listed in the machine's manual. That certainly made my format decision easier. JVC's Digital-S format has met our needs and served us well. When it comes down to it, what more could you ask for? ■


Going digital and watching their pocketbook. Engineers at KRXI chose JVC's Digital-S BR-D750 editing VTR.

Peter Grimm is an engineer for KRXI, Reno, NV.

Design Team:
Ken Dixon, project manager
Catheses Award-Winning Designs, architect
Don Clark, head architect
Phil Davis, architect
Town and Country Electrical, electrical contractor
United Construction, construction and electrical contractor

Field Report

DigiBus and Digital Glue are Doc Holiday's heart and soul

BY TIM ARMOUR

When I set out to build a digital truck, I had a few goals in mind. I wanted this truck to be comfortable; to interface with other trucks and facilities, digital and analog; and to be ready for the DTV future. It was the last of these goals that led me to use Leitch DigiBus and Digital Glue platforms as core structures in Southwest Television Production's newest truck, Doc Holiday.

We ran digitized external signals through DigiBus to synchronize them with Doc's internal signals then we route the signals to the Digital Glue DAs. The DAs include component digital, analog audio and analog video versions. These distribute Doc's signals to switchers, routers and I/O panels.

I chose the product not only because I had success with them in the past, but also, and in large part, because this platform lets me get 10 DAs in a two-rack-unit frame. Space is high on a truck engineer's priority list when making design decisions.

I also wanted flexibility. For instance, this platform provides an analog-to-digital converter and frame sync on a single card (DES-6801). That's an option I've not found elsewhere.

Simple set up and maintenance

In choosing a control platform, I was influenced by installation issues. I liked the fact that the product provides a single point of operation through a separate control panel (UCP-3600). Being separate, the control panel can be placed where it is convenient for the operator, with the processing equipment in less accessible places. And the single point of operation allows the operator to avoid moving from one piece of equipment to another in order to control and maintain the system. The single point of operation also simplifies setup.

Setting up the Digital Glue DAs was simple. But the true value of these DAs is that after the initial set up, I've not needed to touch them — no re-tweaking, no headaches.

That trait is even more rare in a truck than in other production facilities because these trucks are always on the road. It takes a rugged piece of equipment to withstand endless miles of travel down sometimes really rough roads. I knew the Leitch equipment would hold up without drift, because I had made similar installations up to four years earlier that still had needed no tweaking or realigning.

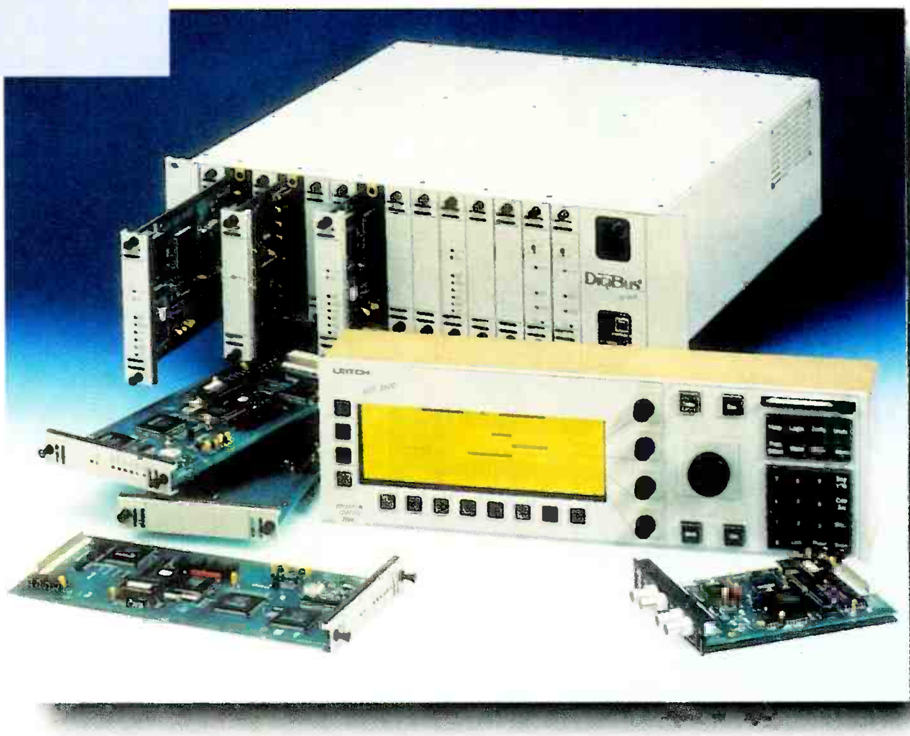
The high-def difference

Ruggedness isn't the only trait that makes the Digital Glue DAs appropri-

Performance at a glance:

DigiBus frame synchronizer
- Up to 13 hot-switching 4:2:2 frame syncs can be housed in a single frame
- Analog or digital inputs and outputs available
- Optional audio synchronization and multiplexing

Digital Glue serial video DA
- Transparent to all serial video data rates, including 16:9 (360Mb/s)
- Low cost eight-output serial DA with compact design (10 cards in 2RU)
- Automatic input equalization



Leitch DigiBus digital conversion platform.

ate for use on a digital production truck. When I was selecting equipment for Doc, this product line was the only one with a 360Mb bandwidth requirement. The standard 270Mb data path wouldn't get me through high-definition production projects. Digital Glue's VSE-6801, with its 360Mb data path, will give me a higher definition and will prepare Doc for HDTV.

I expected to upgrade some parts of the truck as the future of DTV becomes clearer, but I didn't want the core equipment to need changing. To remain competitive, we'll need to provide seamless service throughout this transition, and that means leaving the core intact. With DigiBus and Digital Glue, I can be confident that Doc's core is prepared, whichever way the industry moves.

Smooth operator

Having discussed these products' dependability and ease of use, I probably should support my claims with test results. But truthfully, once I set up Doc's equipment, everything operated

Doc Holiday's control center, featuring many racks of Leitch DigiBus and Digital Glue.

so smoothly that I saw no need for in-depth testing. I have always found this manufacturer's published specs to be reliable, so I just trusted them. Then, when I got both systems up and running, they appeared to be operating just as promised.

The one problem I did have proved to be the result of the digital revolution, not Doc's control platform. When I couldn't control levels or change colors on my video, I briefly doubted the serial digital frame synchronizers, when in fact, level adjusts can't be done effectively in the digital realm with any manufacturer's frame syncs. What seemed like a problem with my equipment was just another lesson I had to learn about which operations are best done in the digital realm and which are better handled in analog.

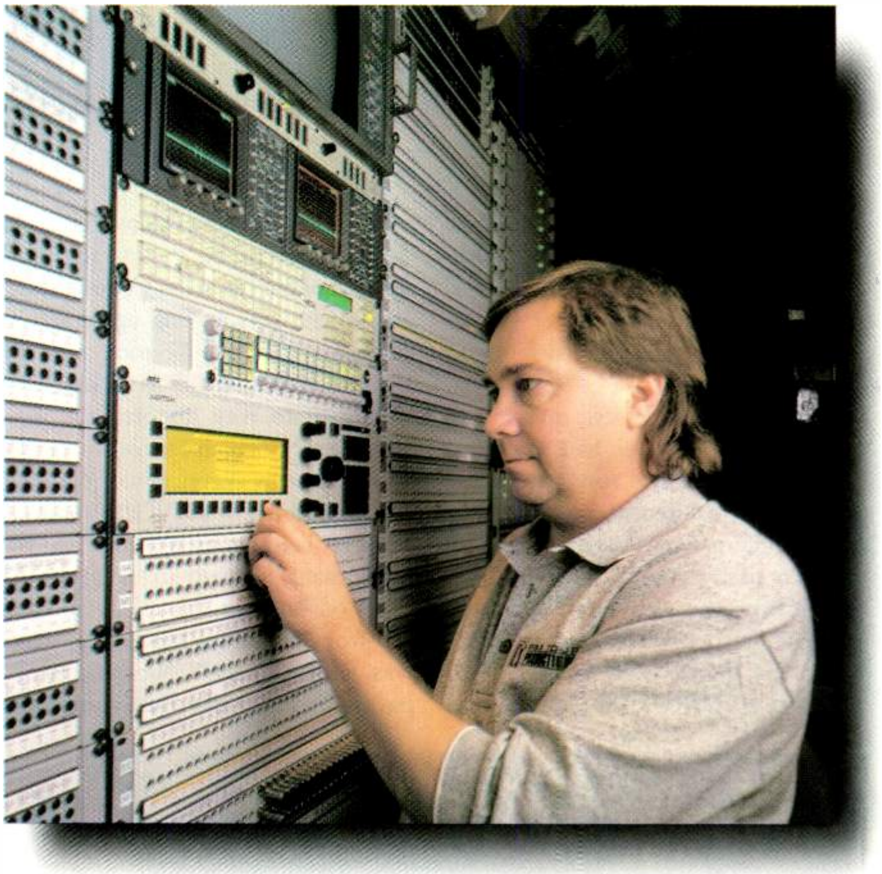
Sometimes, these controllers and DAs surprise me with bonus features rather than challenges. One such instance involved the DigiBus audio synchronizers (AVS-3600-E). I intended to use that module simply to embed program audio into Doc's datastream for end distribution. But I soon found myself at a gymnastics event where I needed to delay the house feed audio to avoid an echo and make the signal match the sound in the stadium. I was able to use the audio delay units to make my audio match what the microphones were picking up.

What seemed like a problem with my equipment was just another lesson I had to learn about which operations are best done in the digital realm.

Performing that task also proved that the product's documentation is clearly written and helpful. Having never configured DigiBus for audio delay, I turned to the manuals and I found straightforward directions for completing the task. Granted, I would have really liked to have more of a map-like guide, but I was able to do just what I wanted by following the manufacturer's directions, without any backtracking or problems.

Satisfying support

To guarantee that I was configuring the audio delay correctly, I called the company and found its phone support helpful. The real difference in the support was not so much in the answers I received (beneficial as they were); the difference was that my calls were routed directly to someone with the answers. Other manufacturers seem to protect their core of design specialists who have the answers by burying them down a few levels in the phone support structure. So, I spend a lot more time and experience a lot more frustration



Tim Armour, vice president of engineering for SWTV, operates DigiBus from a separate control panel.

trying to get answers to sometimes urgent questions. With Leitch, even when I go through voice mail I get return calls and answers quickly.

On the subject of service, it's worth noting that the company accommodated my strict and somewhat different delivery demands. Whereas I usually order equipment on a short deadline, I planned this project well ahead of time. I was investing 3.5 million dollars and I wanted to spread my costs out over a longer time frame. I specified a series of deadlines for delivering portions of my total order and the manufacturer met every scheduled delivery date to the day.

In fact, the only delivery-related trouble I had with this company was in once receiving the wrong version of a product. Flawed communication was clearly to blame. But in other experiences with this manufacturer, the latest included, the service was pleasing.

Service alone, however, isn't enough to guide buying decisions. Product performance is key. Above all else, I must know that when I get to an event, my equipment is going to work. I trusted these products at the outset because of their good track record in previous installations and the fact that they have become standards on digital trucks. Based on their performance on Doc, I'd say these products are so popular because they just work. They do their jobs and I don't have to worry about them. That means I can worry about more important things, like pleasing customers.

Tim Armour is vice president of engineering for Southwest Television Production Services in Tempe, AZ. He was the chief design engineer on SWTV's digital production truck, Doc Holiday.

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Field Report

Panasonic DVCPRO: Covering the Super Bowl with Denver's KCNC

BY BOB BURKE

Super Bowl XXXII was much more than another big sporting event to KCNC-TV, Denver's CBS affiliate. The game and events leading up to the big game galvanized the entire region. Full of sentiment and genuine drama, it was the Broncos' veteran quarterback John Elway's chance at a Super Bowl victory after three previous losses there, as well as an opportunity for the American Conference to end a 13-year losing streak. Beyond our viewers' insatiable desire for news about the team from San Diego, it was an important showcase for the station to meet and match our competitor's coverage. We had big expectations for our DVCPRO equipment, which the station had installed five months prior.

Last spring, the CBS network had announced it would purchase more than 1,400 units of DVCPRO from Panasonic to equip 13 of its stations with the component digital ENG equipment. The new gear has enabled KCNC to make a complete conversion to DVCPRO for field acquisition and news editing.

In making this large-scale investment, CBS station executives had evaluated the high maintenance costs of existing analog news equipment and started to look for alternatives. An extensive evaluation at sister station KYW-TV in Philadelphia proved successful. With the equipment widely available at an attractive price, the decision was made to purchase DVCPRO. The CBS stations needed to reduce maintenance costs and replace aging analog equipment.

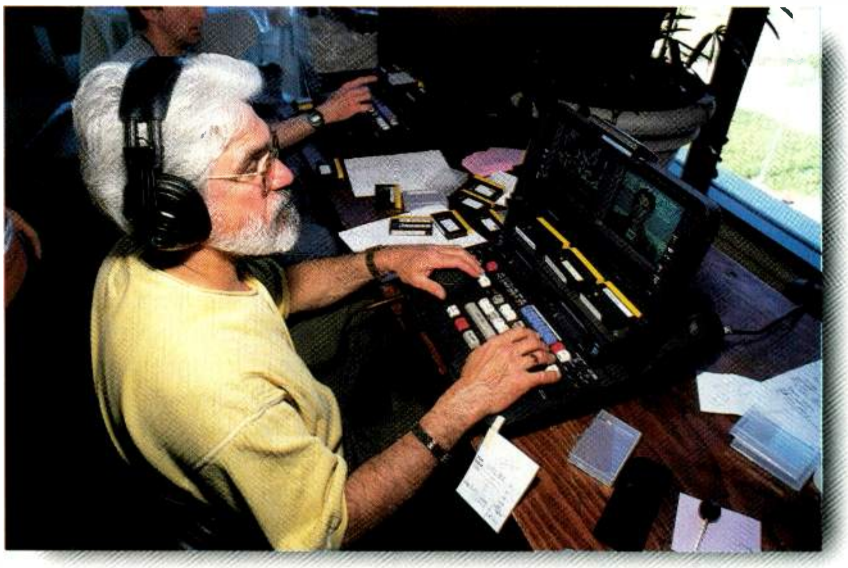
Performance at a glance:

AJ-LT75

- Full editing capability in the field with component digital video quality
- High picture quality DVCPRO format
- Portable and lightweight for editing any time, any place
- Two independent DVCPRO digital VCRs for on the spot output/back-up function /two color 6.5-inch LCD monitors
- Built-in stereo speakers
- A complete cuts-only editor in a briefcase-sized package

AJ-D700

- 1/2-inch 3CCD DVCPRO camcorder
- Lightweight — 13 pounds including lens, 1.5-inch viewfinder, cassette and battery pack
- Superb picture quality: 410,000 pixel FIT CCDs
- Viewfinder features 600 lines (monochrome) horizontal resolution /63 minutes of recording time
- 20W power consumption
- Set-up memory card



KCNC editor using the AJ-LT75 to edit field packages at Super Bowl XXXII.

DVCPRO convert

Early last fall KCNC took delivery of 114 DVCPRO units, including nine AJ-LT75 laptop editing systems, 31 AJ-D700 3-CCD broadcast camcorders, 22 AJ-D750 studio editing VTRs, 38 AJ-D650 studio editing VTRs and 14 AJ-D230 player/recorders.

We've been particularly impressed with the performance of the camcorders and the field editing systems and felt confident relying on them as the key components of our Super Bowl coverage. That coverage comprised reports sent back for each of our seven daily newscasts for 10 straight days leading up to and including game day. We took nine AJ-D700s and four AJ-LT75s to San Diego, which in no way hobbled the news teams back home in Denver.

I was initially skeptical of the format, however, I am now a DVCPRO convert. I'd never been happy with MII and was not looking forward to having to depend on another Panasonic product. But from my initial experience, which was with the AJ-D700 camcorder, I have found that that the equipment is incredibly reliable.

There is general agreement among KCNC's 31 photographers that the DVCPRO camcorders perform beautifully. There are no dropouts, there is longer tape time and the sound quality is much better than MII. The picture quality is more than acceptable for news purposes. The equipment performs so well in any lighting conditions that we no longer travel with lighting.

Above all, we appreciate the reduced weight of the camcorder. It's much lighter, a typical difference of 15 pounds. With a camcorder in one hand and laptop editor in the other, we're prepared for field work.

In Denver, there is an AJ-LT75 in each of our seven ENG microwave and satellite trucks and we reserve two laptop editing systems for travel, primarily for sports coverage. Before the arrival of the laptop editor, we did barely any editing in the field and were routinely getting beat on spot news by our competition, which touts several mobile newsrooms. Photographers had to send their stories back shot by shot, someone else would edit them and the pieces didn't look as good as they do now. It's always better if the person who shoots the story edits it, and because of the laptop editor, it is now our standard operating procedure.

The AJ-D700 was used on KCNC's temporary set as well as for field work. The Super Bowl stadium was the backdrop to KCNC's temporary set.

Having the edge

With the laptop, we're doing better work in the field and we've pulled at least even with our competition on spot news coverage. For our Super Bowl coverage, we assigned an AJ-D700 to each of our seven photographers on site and reserved two for the set; we placed one AJ-LT75 in our digital satellite truck and set up three at our workstation behind the hotel where the Broncos' players were staying. Not one thing broke, and our director of operations credits the gear with helping KCNC-TV consistently beat the competition with a staff only half as large as theirs.

After shooting the game with the AJ-D700, I can attest that it was great not to be in agony from the weight of the gear. I only needed one battery to shoot the entire game. The camcorder handled the stadium's notoriously bad light conditions well; I was shooting 2X on a 20:8 lens with the shutter on and never had to put up the gain, which I thought was impressive.

When you're in a game situation, it's nice to have the longer DVCPRO tape (I shot with 30- and 60-minute tapes), and its small size was noticeable. I kept the tapes in my pocket; I looked around the field and saw my peers with stacks of big tapes around their feet! Also in San Diego, we took advantage of the equipment's flexibility in recording in/playing out different tape formats. At the CBS station in San Diego, we were easily able to plug in a cable and record off a beta deck into our DVCPRO camcorder.

Denver's NBC-affiliate KCNC, sent four of its nine AJ-LT75 laptop field editors to cover the Denver Broncos at Super Bowl XXXII.

What stood out in my mind about the laptop editing system on the road is how extraordinarily easy it is to transport. I don't know if we can even calculate the savings in time, energy and shipping costs. The cameramen love to work with the laptops; they're highly reliable and they've quickly become a kind of iconographic object of fascination in the business — people want to stop and watch you edit.

The laptop gave us a nice edge right after the game. We had five photographers on the field and one guy with a laptop. He did a live hookup to the satellite, so we were able to feed stuff live to Denver before NBC's post-game coverage was over. We could not have done that before. We couldn't have realistically or affordably set up an editing station on the field, and if we had, we would have needed an engineer on the scene.

With the AJ-LT75s we don't have to worry about editing anymore. The next stop for them was Nagano, where we won't have to be concerned about customs for a change.

Sports writers have called Super Bowl XXXII one of the most competitive in history; it was a thrilling win for the Broncos and exhilarating for us to be on site to document it. Certainly, it was a competitive situation for KCNC-TV and Panasonic DVCPRO supported us in scoring some important goals of our own.

Bob Burke is chief photographer at station KCNC, Denver and executive producer for Super Bowl XXXII coverage.

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Server clustering for broadcast digital video

BY TOM CHRISTENSON

A broadcaster's first line of defense in keeping digital video applications running is to plan for system-wide fault resilience at the video server level. In the best interest of protecting critical revenue streams, broadcasters can build a highly effective redundancy strategy without draining their budgets. Consider the advantages of a server system that scales economically (in terms of storage and input/output channels); that offers a high level of fault resilience; and that meets these goals while costing less than a mirrored approach.

MediaClusters

A MediaCluster is a network of directly connected video servers that act as a single server. MediaClusters were designed by SeaChange based on its core competencies in computer networking and data storage with a focus on delivering high-quality video for the TV industry. Unlike a single larger server, the MediaCluster servers can fail independently without loss of access to video files. All the servers see the same media and can access any portion of the media without regard to the number of other concurrent accesses to that same portion of the media. This network of servers carries MPEG-2 data as it is read from storage and written to video decoders for broadcast or played as a transport stream. Servers in a cluster can handle a variety of compression formats, so transport streams can be supported with DVB, 4:2:2 or 4:2:0.

The MediaCluster architecture provides access to clips as data objects in the same way a file server provides files to network clients. Because MediaCluster members manage their own file systems and export access only to the data objects, each MediaCluster member can read, write and delete files from its local file system without disrupting other servers in the cluster. Data objects are fragmented and written to the members of the cluster using RAID-5 striping and parity techniques.

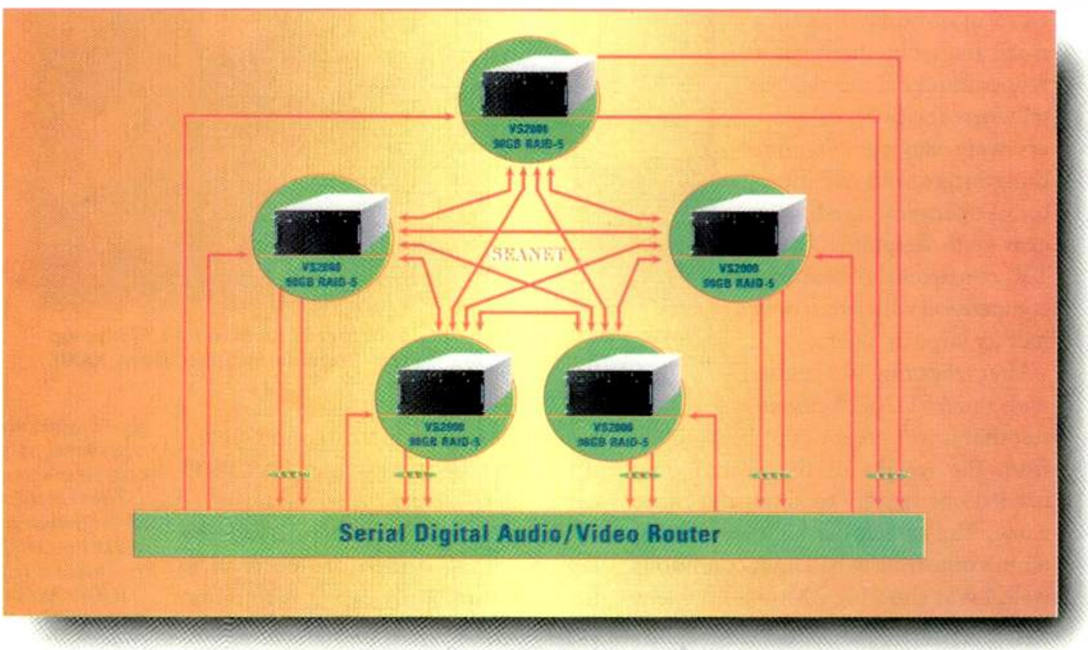
In the instance of a link failure, the system automatically recovers and load balances itself.

Fault resilience

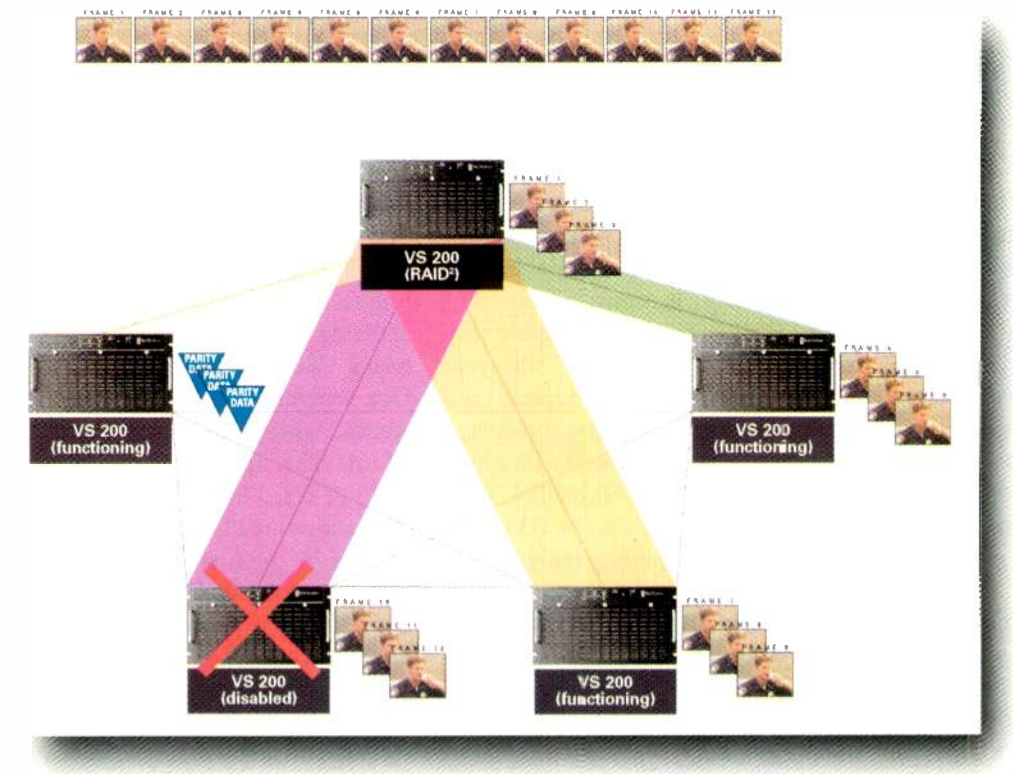
The core feature of the MediaCluster is its unique level of fault resilience. As explained previously, data is striped across all servers in the cluster. In addition, the system can optionally generate parity blocks. Think of parity blocks as the total sum of all the data in a stripe (normally one rotation around the cluster). If a block of real data is lost, the parity data regenerates the lost data by calculating the partial sum of all of the other data and subtracting the partial sum from the total sum (the parity data). This technique is done in real time so that it does not appear that any data (or server or link) was lost. The approach is doubly useful because it masks connection failures, as well as server failures.

A data storage technology called RAID striping stores data for each file across all disks in a server with redundant data called parity. This technique enables data on a failed disk drive to be reconstructed from parity data stored on surviving drives and ensures that, system-wide, data is not lost as a result of a single drive failure.

A MediaCluster can switch and store MPEG-2 streams in a fault-resilient manner. The failure of one server does not interrupt service delivery for longer than it takes to reconnect from remaining MediaCluster servers, any of which



In this five-node design, data is striped across all of the servers in the cluster, which masks any connection or server failures, thereby increasing the on-air reliability.



Because every server is connected to every other server, reconstruction of any missing video is seamless and the video stream continues unaffected.

will resume the interrupted service in less than one second. As a result, no service disruption is detectable.

The media inventory of a MediaCluster can be managed via local computer system programming interfaces even while the system is recording and playing back the media at a constant bit rate. The programming application programming interfaces (APIs) and inventory transfers always defer to the real-time playback/record functions.

Load balancing

In the instance of a link failure, the system automatically recovers and load balances itself. Load balancing occurs because the servers involved use different sets of servers to reconstruct the missing data. Load balancing in a MediaCluster apportions an equal amount of data to each server's storage subsystem, producing many benefits including:

Better systems component use: Components like CPUs and the drives in a storage subsystem are all fully utilized in a balanced system as opposed to a system where some drives are loaded and others are not.

Higher performance: Data processing capabilities are greatly increased if all systems share an equal load as opposed to an unbalanced system where some subsystems have too much data to process, while others sit idle.

Load balancing that results from video data striping allows a system to function consistently at peak efficiency.

The incorporation of RAID striping technology at the RAID storage subsystem level, as well as at the node level is referred to as RAID2 (RAID squared) and enables a MediaCluster to be as fault resilient as is required by many high-availability media applications.

Expanding the system

The number of servers in a MediaCluster is variable and scaleable depending on storage requirements. MediaClusters now support up to five servers, with nine server configurations soon available. Storage capacity can be increased by adding disks to each server's chassis, adding expansion chassis to servers or by adding servers to a MediaCluster. Bandwidth also can be increased by adding servers to a MediaCluster. As each new server is added, any media content on the newly added server is merged with the on-line MediaCluster inventory.

Although mirroring systems may have seemed like a simple way to build fault tolerance, it's an approach that has become increasingly impractical for the TV industry. As broadcasters aim at delivering high-bandwidth full-motion digital video, they will require vast amounts of storage for recording, scheduling and playing. Server clustering reflects emergence of video technologies that will support broadcasters' digital future. ■

Tom Christenson is director of broadcast sales, eastern U.S. region, SeaChange International, Maynard, MA.

Applications of picture quality measurements

BY JEFFERY O. NOAH

Direct picture quality measurements are a revolutionary step for the TV industry; a step necessitated by the broad adoption of compression technologies. TV systems using compression do not behave in the relatively linear manner of analog or uncompressed digital systems. So, the heretofore adequate indirect signal quality measurements are relatively useless for the engineer working with compressed digital television — thus the need for a new testing paradigm.

With many broadcasters moving toward multicasting for some significant portion of the day, evaluations of standard-resolution encoders is one task they'll face in the near future. Prior to the availability of direct picture quality measurements, encoder evaluations relied upon a few expert viewers in the facility doing their best to get a feel for the performance of a number of devices at a variety of bit rates with a variety of program material. The result was a mass of data accumulated over a period of time based on perceptions of a few people viewing the material in what were typically uncontrolled environments. Short of performing tightly controlled tests to the ITU-R BT500 specification, this scenario was typically the best an average facility could manage.

Fortunately, the instrument with which direct objective picture quality measurements may be made, the Tektronix PQA200 picture quality analyzer, has reached the marketplace in time for all but the early adopters of compressed video for broadcast operations.

Although a few different methods have been proposed, picture quality measurements based on human vision system models provide the strongest correlation to rigidly controlled subjective viewer trials. In fact, such systems can provide greater than 88% correlation to rigorously controlled viewer trials, without the time, expense and headache associated with those trials.

Picture quality basics

At the heart of the PQA200 are two boards shown as compute engines in Figure 1. Both contain 128MB of SDRAM and a pair of Texas Instruments C80 DSPs for compute power. One generates the Rec. 601 reference scenes, which are supplied on CD-ROM. The appropriate sequence is easily selected for playout via the SDI I/O (composite I/O is optional). During playout by the first board, the second acts as a store for the degraded scene that has passed through the encoder under test.

The sequences supplied are five seconds long, but only the third and fourth seconds of video are measured for picture quality. The measurement board captures these two seconds of degraded video from the encoder under test, and also takes the same two seconds of reference video from the generator for comparison.

Let me take a moment to point out

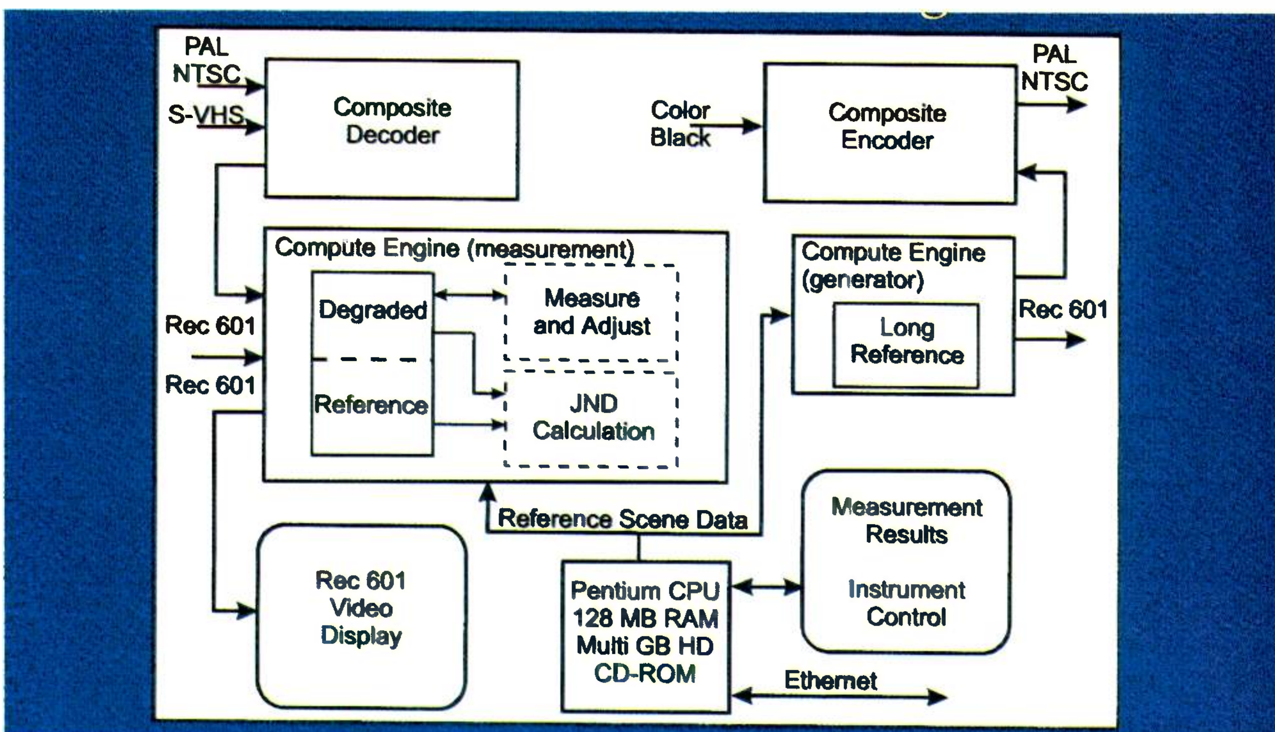


Figure 1. This simple block diagram indicates the basic components of a picture quality measurement set. Identical processing cards perform the functions of signal generation and capture and analysis.

that the measurements discussed in this article are off-line, non-real-time measurements. Currently, the PQA200 requires calibration stripes to dramatically reduce the time and CPU effort required for pixel alignment. This is far from acceptable for facilities running 24x7. Also, the algorithm used to quantify the captured data and the large amount of data involved, taxes even the considerable DSP power built into the instrument. Significant strides must be made before adequate DSP power is available to perform these tasks in real- or near real-time.

Figure 2. The calibration stripe on the first two seconds of each sequence reduce the processing power (and time) needed to perform subpixel alignment of the degraded and reference scenes. The stripes also contain segments for chroma and luma changes and frame ID for temporal alignment.

The first stage of the measurement is the pixel alignment process. The use of calibration stripes overlaid on the first two seconds of the video sequence simplifies and accelerates the pixel alignment process. The calibration stripes (see Figure 2) also enable calibration of luminance and chrominance gains and offsets and contain data for automatic detection of the specific sequence in use. The pixel alignment process also provides a summary readout including the overall quality score and all the non-picture quality-related changes introduced in the encoder. These include gain and level shifts, x and y shifts in the luminance and chrominance domains and any cropping of picture edges.

After pixel alignment, the reference and degraded sequence may be used to create a peak signal-to-noise ratio (PSNR) value for each frame, but in general will be used to generate a picture quality rating (PQR) value, which relies on a model of the human vision system developed by the Sarnoff Corporation and incorporated in its JNDmetrix (just noticeable differences) algorithm.

Each pixel in each measured frame is evaluated relative to the 16 pixel by 16 pixel block surrounding it (spatial disturbances) and with the same pixel block in the preceding four frames (temporal disturbances). Results are based on the level of visibility of these differences, such that each pixel has a corresponding JND score.

Figure 3. This single-frame degraded image shows a significant loss of detail in the lower right corner and considerable blurring of the spinning wheels of the ride. However, the fact that the wheels are in motion reduces the perceptibility of those distortions — as can be seen in the PQR map. (See Figure 5.)

Frames of these PQR "maps" may be viewed either as still pictures or as moving sequences. This allows the user to see areas of the frame or picture details having the most noticeable differences. Examples of a degraded picture, PSNR display and PQR map are shown in Figures 3, 4 and 5.

The PSNR display shows the location and degree of actual differences in the picture, but the PQR map indicates the level of visibility of these picture differences: white areas in the PQR map indicate areas with the most visible changes and dark areas have the least visible changes.

Finally, the JND values for each pixel are collated within each frame and then over the two seconds of the sequence. This provides an overall PQR for the sequence. Additionally, graphs of PQR and PSNR variations throughout the sequence are available to quickly identify those areas of the sequence causing the most problems. Printouts of graphs and PQR maps simplify the task of comparing different equipment and/or bit rates.

Testing encoders

Other than the viewer's new digital TV set, the link most critical to good picture quality in a digital video transmission chain is the encoder. Using a picture quality measurement tool, the process of optimizing bit rates or comparing the wares of different vendors is relatively straightforward. Given that the measurement instrument eliminates the need for a controlled viewing environment and the same set(s) of rested eyes, testing can be performed by anyone on staff whenever the equipment to be evaluated is available.

Connecting the PQA200 to an encoder can be as simple as taking the Rec. 601 serial digital video from its generator, connecting it to the encoder, connecting the encoder directly to a reference decoder and lastly connecting the reference decoder's SDI output to the PQA200's input. This assumes the encoder and reference decoder have SDI I/O and that their MPEG-2 physical interfaces match.

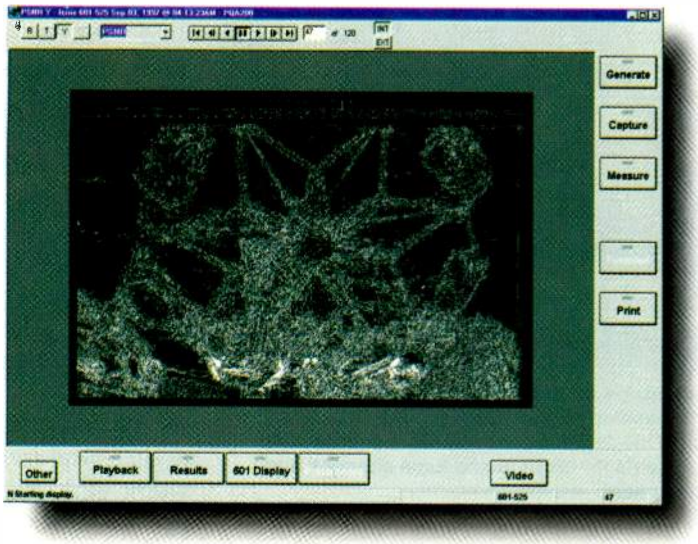


Figure 4. The PSNR map is a relatively raw picture difference display, indicating the pixels most different from the original with the brightest luminance levels. Notice that it does point out the changes in the bottom quarter of the display and the loss of detail in the lower right corner. However, the PSNR map also shows significant changes in the wheels of the ride, but these errors, according to the PQR map, won't be noticed due to limitations in the human vision system's ability to see detail within motion.

To eliminate any variations in the test setup, the same professional reference decoder should be used for all equipment evaluations. Most professional decoders offer SDI video output as standard or at least as an option. Again, analog composite I/O is available for the Tektronix PQA200 as an option. However, if at all possible, removing any composite/component encode/decode cycles from the process will make the picture quality test results a more pure indicator of encoder performance.

Proofing satellite links

The same methodology applies to testing the quality of a satellite link. You might wonder if the delay in the link would be too long for a picture quality analyzer to correlate the received, degraded signal to the reference-generated signal. Fortunately, the generator and capture/analysis cards operate with complete independence. In fact, the reference scenes could even be played from a digital tape machine or disk recorder through a system under test with no linkage whatsoever to the analyzer. However, the "copy" should be verified by the analyzer to ensure its quality.

In reality, a simple satellite link with one encode/decode cycle could be tested with the same result by eliminating the uplink. Because any transmission path errors within the limits of the error correction scheme in use would have no impact on the video data carried in the stream, the picture quality measurement should be identical. However, if the transmission path includes multiple encode/decode processes, the additional decompress/recompress steps could impair the picture quality and should be tested.

Selecting test sequences

More than a dozen test scenes supplied with the PQA200 on CD-ROM, cover a wide range of motion and detail. Many of the scenes are industry standards such as Flower Garden, Mobile and Calendar, Ferris Wheel (which isn't one) and Cheerleaders. Using a phrase directly from the ITU Rec. 500 standard, the scenes included on the CD-ROM were selected because they were "difficult, but not overly so" for encoders to process. Generally speaking, selecting the five to 10 scenes that best represent the types of programming you broadcast is sufficient for an evaluation. Remember, you'll not only be looking at perhaps 10 scenes on at least two encoders, but you're likely to run the encoders in at least four different bit rates. This would yield 80 sets of data, each set including at least a summary report and possibly PQR/PSNR graphs and maps. The point is, you probably don't want to use every scene at your disposal.

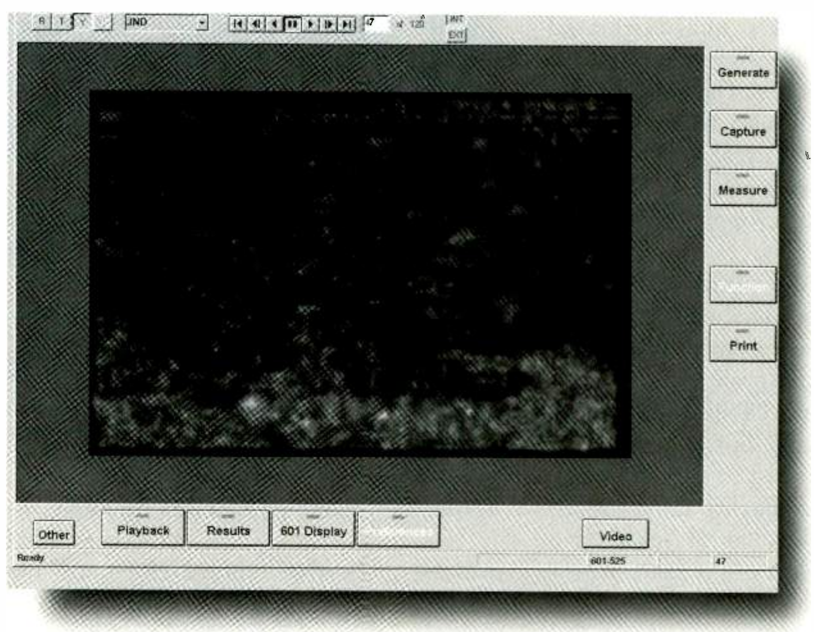


Figure 5. The PQR map highlights only those areas where changes would be noticed by viewers.

Comparing results

The task of making a selection once all the data has been gathered may not be as easy as picking the encoder with the lowest average PQR value over a variety of bit rates and sequence types. Although this may be the overriding factor, picture shifts and cropping do vary from encoder to encoder and may be more objectionable than minor differences in visible encoding artifacts.

Another point to keep in mind is that the concentration of visible errors will probably vary somewhat between devices, a fact that the single PQR metric may not reflect. For example, the PQR map in Figure 5 shows that the encoder allotted too many bits to the quick motion of the amusement park ride on the top three-fourths of the screen, leaving a serious shortage of bits for the fine detail at the bottom of the screen. Another encoder might have allocated bits more wisely, but had a similar overall PQR value. Viewing the PQR maps of the various scenes really draws attention to problems of this nature.

PQR vs. PSNR: Why two metrics?

If PQR values are close between two or more encoders, the PSNR map might indicate some differences in how the video is processed that could prove insightful. Another case where PSNR might be useful is in situations where a PQR value is low (low is good), as encoders are likely to have when operating at relatively high bit rates. In this case, the more direct picture difference indication of PSNR could also help you to reach a conclusion. It's simply another data point to use when trying to make sense of new and unfamiliar equipment and technology.

Using new tools in the digital age

The rapid approach of DTV transmission has created a flurry of activity in the broadcast community. Picture quality measurements are a new tool at your disposal to help you intelligently choose what many argue is the most critical link with regard to picture quality in the transmission chain. Does this mean every call letter station should rush out and order one tomorrow? Probably not. However, larger-market stations, station groups and networks may have a strong enough ongoing need to look at new equipment to justify the purchase. Smaller stations might opt for a month or two rental when the time comes to make the jump to digital.

Although the out-of-service tool available today is extremely useful, real-time, operational monitoring of picture quality is the ultimate goal. With picture quality measurement technology in its infancy, rapid improvements in operating speed, combined with Moore's Law of ever-increasing processing power, promise to make in-service picture quality monitoring a reality in the next few years. ■

Jeffery O. Noah is a product manager for Tektronix, Inc.'s TV test product line in the company's Measurement Business Division, Beaverton, OR. He has published numerous articles on audio, video and MPEG testing.

Technology In Transition

Commercial insertion systems

BY THE *BE* STAFF

Inserting local spots in network programming has moved from the rank of generating some revenue for cable systems to generating significant revenue for systems. No longer are operators content with airing a few spots per day, they want to load up as many local, regional and national breaks as their programs will allow.

This used to be problematic because the spots were housed in a rack of 3/4-inch machines, or in some cases, VHS decks. Unless you built a daily spot reel, this meant one spot per VTR, which greatly limited the number of potential spots that could be kept on-line at one time. And, with VTRs, mechanical failure was always possible.

Video disk storage solved both of these problems. Now, many hours of high-quality storage is available on highly reliable disk recorders. Although it's possible to simply use the disk storage as a replacement for VTRs, adding a bit of local control software vastly improves the flexibility with which cable systems can air spots.

What to look for

With that background, what should you look for in commercial insertion systems? First, look for digital. Don't consider any other storage technology. Second, look for an integrated system. Although buying parts and pieces may work it opens you up to finger-pointing. There is one important exception here. The server is often from one vendor and the control software and interfaces from another. That's okay. Rely on the advantages afforded by each. But, I don't recommend building your own.

First, develop a general plan of what you want to accomplish. Second, review the following vendors, keeping in mind what features you need. Third, contact each of the companies and get their input. Fourth, redefine your system in terms of what they propose and see if you're still getting the features you need. If not, then you've shortened your vendor list. Finally, ask for a list of previous customers and call some. See if the vendor delivered — and then supported the client after the sale. Many times, after-sales support is more important than any claimed front-end advantages a vendor may tout. ■

QUESTION	ASC Audio Video 818-843-7004	Channelmatic-LIMT 619-445-2691	FloriCal Systems 352-372-8326	SkyConnect 303-218-9100	SeaChange 508-897-0100
Model	VR300 video server	DMM (digital MoneyMaker)	AirBoss-NT	HE-440	MediaCluster
Separate software req.	NO	NO	YES	NO	YES
Integrated software package	Columbine/ JDS	All	BIAS, JDS Columbine, Enterprise Summit Focus	LAN, Compulink, CCMS, VisionTel, INTABS	Louth VDP, OmniBus protocols
Automation supported	Louth, Odetics, Alamar, Pro-Bel, Newsmaker	ARTI	FloriCal Systems	-	-
Compression type	Motion JPEG 4:2:2	MPEG	JPEG, MPEG-2	MPEG-2, 3-12Mb/s	MPEG-2, 4:2:2 studio profile/4:2:0 ML, mixable
Compression level	2:1 to 20:1; User selectable	MPEG-1/ MPEG-2 full & 1/2 D-1; User selectable	User selectable	MPEG-2 User selectable	6Mb/s-24Mb/s
Fault-tolerant	Software-based RAID	RAID-single channel integrity	RAID and mirrored storage	RAID-5, redundant switches	RAID² with RAID-5
Archive method	StorageTek, Ampex	RAID-Tape	DLT, Storage Tek	DLT,DAT, JAZ, HSM	StorageTek HSM for NT
Server capacity	24 channels/ arbitrated loop	12 channels	24 channels, unlimited expandability	40 channels	20 I/O channels unlimited expandability
Hours stored per quality level	35 hours at 24Mb/s per loop	4 1/2 hours at 5 Mb/s	16-62 hours at BetaSP quality level 72Gb-278Gb	Depends on compression rate	16 hours at 24Mb/s, 4:2:2 studio profile, or 48 hours at 8Mb/s, 4:2:0 main profile, 96 hours of storage at 8Mb/s or 32 hours at 24Mb/s
Scalable expansion	2-24 channels	Event/time	Scalable to 100s of channels with 100baseT, FDDI and ATM	1-40 channels/ server; unlimited storage capacity	12 I/O channels with 16 hours of storage at 24Mb/s; 4 I/O channels and 8 hours of storage at 24Mb/s per node expansion
RS #	205	206	207	208	209

Table 1. Once you have defined your feature set, the above table will allow you to compare the five vendors' solutions.

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PRODUCTION SYSTEM SHIPS WORLDWIDE

Softimage/DS: this system brings together on the Microsoft (R) Windows NT (R) operating system a comprehensive non-linear production system for creating, editing and finishing videos, in one integrated environment with a common interface; it combines the functionality of a full on-line post-production company into one environment at a fraction of the cost; Softimage/DS began shipping earlier this year as a turnkey system with Intergraph Corporation's StudioZ for Softimage/DS; 818-365-1359; www.softimage.com

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RELIABLE DIGITAL VIDEO AND AUDIO STORAGE

Avid Technology iS Pro series: this new and powerful line of storage drives includes a 9GB and a revolutionary 18GB storage drive in a 3.5-inch format; both drives are available in fixed and removable formats offering increased performance, reliability and investment protection; the iS Pro series is designed to work with the Avid MediaDock removable storage systems and the Avid MediaDrive fixed storage devices; using iS18 Pro drives in a fully loaded MediaDock (eight drives) allows storage of 140GB of digital media, which is more than 50GB higher than previously available; 978-640-6789; fax 978-640-1366; www.avid.com

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STUDIO MASTERING PROCESSOR LAUNCHED

TC Electronic Finalizer Plus: the newest generation of the Finalizer mastering products replaces the original Finalizer; the Finalizer Plus offers a more advanced set of features and enhancements including 24-bit resolution analog-to-digital and digital-to-analog converters, real-time sample rate conversion that supports sample rates from 32kHz to 48kHz, word clock input via BNC for post-production users, ultrastable digital clock for rock-solid jitter-free digital I/O and an ADAT port for direct analog to Lightpipe stereo conversion; 805-373-1828; info@tcelectronic.com; www.tcelectronic.com

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DV & DVS FLUID HEADS RELEASED

OCONNOR Ultimate DV & DVS fluid heads: these full-featured and compact fluid heads weigh only 6.3 pounds and are perfect for DVCam, DVCPRO and other small-format 3-CCD camcorders; the counterbalance is infinitely adjustable, which enables tuning of the head to precisely neutralize the camcorder's weight throughout the entire tilt range; the capacity of the DV head is 24 pounds and the DVS head is 32 pounds with 90° tilt in either direction and 360° pan; 714-979-3993; fax 714-957-8138

Circle (505) on Free Info Card

MAKEOVER FOR COMPACT PROFESSIONAL MIXER

EVI DDA CS3: EVI has revised its DDA CS3 professional mix to bring its appearance and specification in line with its big brother, the CS8 and with EVI's Midas range of consoles; the revisions consist of visual and component changes such as higher profile potentiometer controls for positive tactile feedback; the color scheme of the DDA CS3 now matches the CS8 and the Midas range for easier identification of the main module controls; +44 (0)1562 741515; fax +44 (0)1562 745371;

Circle (506) on Free Info Card

IMPROVED SPECS FOR ROUTING SWITCHERS

Knox Video RS16x16: new engineering designs and technologies have allowed the expansion for the video bandwidth and audio headroom on the RS16x16 BAL full-matrix routing switchers; the new, improved units are available at the same price as their predecessors and are housed in the same ultrathin chassis; a maximum video bandwidth to 200MHz is offered and the balanced audio headroom is now greater than +18dB; 301-840-5805; fax 301-840-2946; www.knoxvideo.com

Circle (507) on Free Info Card

Business

Acrodyne Industries has been awarded a contract to manufacture and install an adjacent-channel technology (ACT) transmitter at KBLR-TV in Las Vegas. The ACT transmitter enables KBLR to operate two channels through a single transmitter, transmission line and antenna. The contract includes transmitter, dual-channel antenna and transmission line. It is scheduled for turn-on by the opening of NAB 98 in April.

SkyStream Corporation has formed a strategic alliance with International Datacasting Corporation (IDC), that designs, manufactures, installs and supports digital audio and data broadcasting products for the satellite broadcast

industry. SkyStream's systems will be used as a head-end for IDC's digital data broadcasting systems, SuperFlex. The first installation is by one of IDC's European customers to broadcast data to corporate subscribers.

Bruel & Kjaer has been officially changed to DPA Microphones, but will continue to manufacture microphones for all aspects of the entertainment industry. However, the divergence of the two companies led to the decision to discontinue the badging of series 4000 studio-quality mics as Bruel & Kjaer. The new DPA microphone series 4000 range will use B&K capsules in its design and will continue to support the large number of B&K mics already in use in the audio community.

Pluto Technologies International Inc. announced that the Turner Production Effects and Advanced Imaging division of Turner Entertainment, recently acquired eight VideoSPACE digital video recorders. VideoSPACE works as an all-purpose recorder, connecting many facets of the facility into a seamless digital operation.

Turner is using the units in a fully integrated mode in its digital facility, handling everything from real-time compositing to image transfers from 3-D, Macintosh and Flame.

Drake Automation Ltd. (DAL) has moved from its original location in Welwyn Garden City to its new headquarters in Chineham (UK). The new location for the worldwide operations provide sales, marketing, training, support and corporate functions. For more information, contact Drake at +44 (0) 1256 379 000.

The Associated Press has been awarded a contract to install NewsCenter, its new Windows-based broadcast newsroom computer system at Marquette University's College of Communication. The university will use the system for production of local newscasts and classroom training. NewsCenter integrates script writing, rundown management and timing, on-air control, prompting, captioning, assignment planning and an indexing engine for real-time news wires and a graphical interface for linking external devices.

Pinnacle Systems announced that its Lightning and DVExtreme systems were used at the annual Houston Livestock Show and Rodeo. Both Lightning, a multichannel image-management system and DVExtreme, a multichannel, real-time digital video effects generator, were used for simultaneous closed-circuit telecasts in the Astrodome complex for live pay-per-view broadcasts. The Houston Livestock Show and Rodeo has two three-channel unit Lightnings with remote shotboxes, which it uses year-round because of the systems' still-store capabilities.

JVC announced that Carolina Pictures, PBS-affiliate, WLRK, Hilton Head, SC, has selected the Digital-S with 4:2:2 component digital as its recording format. Carolina Pictures made

the move to digital by purchasing JVC's Digital-S BR-D40 dockable recorder and its KY-D29 digital signal processing camera.

Philips BTS was chosen by KPBS, San Diego's public broadcasting station, to supply an integrated master control routing, switching and video server system for the station's new all-digital broadcast facility. The Philips Saturn master control switcher, Venus routing switcher, Diamond Digital 35 production switcher and Jupiter control system provide an integrated system solution for controlling the station's digital broadcasting environment.

Telex Communications announced the successful closing of a merger with EV International (EVI). The combined companies, controlled by affiliates of Greenwich Street Capital Partners, will be headquartered in Minneapolis. The new company, which will operate as Telex Communications, will have more than $355 million in sales and approximately 3,300 employees worldwide.

Panasonic announced that Matsushita Electric Industrial Co. Ltd. (MEI) of Osaka, Japan, signed a contract with the Sydney Organizing Committee for the Olympic Games (SOCOG) through the Sydney Olympic Broadcasting Organization (SOBO) to become the official host broadcast equipment supplier for the 27th Summer Olympic Games to be held in Sydney, Australia, in 2000. As the host broadcast equipment supplier under this contract, MEI will deliver Panasonic digital broadcast cameras and VCRs, professional audio equipment and TV monitors to SOBO. SOBO is the organization established by SOCOG to provide coverage to nearly 200 international radio and TV broadcasters.

RT-Set announced that CBS 2 New York has purchased a live-to-air Larus Virtual studio system for use in its daily newscasts. The station is the first local TV news operation in the United States to bring this virtual studio technology to daily news programming.

The system offers possibilities for changing the style and look of a news presentation. The system is incorporated into a newly built news set that makes extensive use of 3-D virtual sets and objects. The sale is the third RT-SET virtual studio system announced this year by a major TV broadcaster.

Comark Communications has been selected by Sinclair to lead a technology team in a demonstration on the potential of multicasting and other DTV applications, including HDTV. The Sinclair demonstration will consist of simultaneous DTV transmissions on two channels in the Baltimore market area, using Comark's solid-state transmitters and ATSC-compliant 8-VSB systems hardware.

Chyron Corporation (USA) announced that CNN has selected its Liberty paint and animation system to create the multitude of high-end graphics needed for its news organization. Each news channel, including CNN Headline News, CNNSI, CNNfn and CNN Español have been fully integrated with Liberty, with a total of 23 systems in-house. A complete 2.5D paint and animation digital graphics studio operating on the Silicon Graphics platform, Liberty integrates paint, effects, image processing, color correcting, text creation, morphing, motion tracking, compositing and animation.

DiviCom Inc. announced that its compression technology has been selected by BellSouth for its new all-digital wireless TV service launched in New Orleans. BellSouth's Americast programming service offers viewers more than 160 channels of national and local programming, as well as movies on command. The company's state-of-the-art digital transmission center is built around DiviCom's MediaView video encoder and multiplexer systems, which compress and combine the video signals for maximum transmission efficiency.

ASC Audio Video Corporation has moved its corporate headquarters to a new location. All correspondence should be directed to the new location at 4400 Vanowen Street, Burbank, CA 91505. The telephone and fax numbers are the same.

Quantel announced that KXTV, the Sacramento-based ABC affiliate, has purchased a Hal 501 video design suite for use with its on-air graphics. The system provides users with creative potential for developing images. It joins the station's Quantel Harriet, Paintbox and four Pictureboxes.

Quantel also announced additional deliveries of its equipment, including one Hal 504, one Paintbox Bravo to CNBC, Fort Lee, NJ; one Henry V8 upgrade to Soho Post & Graphics, Toronto; one Editbox 2010 upgrade to KTBC, Austin, TX; one Paintbox Express upgrade with Picturenet Plus option to WCOO-TV, Minneapolis; and one Paintbox Express upgrade to ABC-TV, Los Angeles.

Vela Research Inc. has established a new sales office in Sunnyvale, CA. In response to a growing customer base, the new office will serve the Western United States, as well as the Asia Pacific region. With the expansion, these regions will have better access to sales and customer support of Vela's video

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QUICK DIAL 74

SONY

DSR-200 3-CCD Digital (DVCAM) Camcorder

Incorporating DVCAM technology, the DSR-200 records an incredible 500 lines of horizontal resolution at 5.5MHZ. To complement the video, the DSR-200 also records audio digitally for a breathtaking dynamic range of 96 dB. And since video and audio signals are recorded digitally, you can copy or edit multiple generations with no loss in picture quality.

3-CCD Camera System

Three CCDs, each with 410,000 active pixels deliver incredible color fidelity and dramatically improved S/N ratio. Also offers superb sensitivity of only 4 lux minimum illumination.

10X Optical/20X Digital Zoom

Variable servo 10X optical power zoom lens goes from 5.9 to 59mm in 1.7 to 24 seconds. The manual zoom rocker is continuously variable right up to where the digital 20X zoom kicks in.

Super SteadyShot

Using a proprietary motion sensing system, Sony's Super Steady Shot reduces high frequency camera shake without compromising image quality. SteadyShot uses horizontal and vertical motion sensors that allow it to work accurately while zooming, moving (even shooting from a car), and shooting in low light conditions.

Digital Effects

- Effects include audio and video fade, Overlap and Slow Shutter. In overlap mode, the last frame of the preceding scene dissolves to the action being recorded. In slow shutter it is possible to record in very low levels of light, albeit with MTV strobe-like effect.
- Time-lapse record capability is selectable from 0.2 to 2 seconds in intervals from 30 seconds to 10 minutes.
- Frame recording mode lets you record with a stop-motion animated effect. You move the subject a little and the camera can record six frames before going into standby mode.

Exposure Control

- Automatic and manual focus, iris, shutter, gain and white balance. Iris is adjustable in 12 levels from F1.6 to F11, shutter from 1/4 to 1/10,000 of a second in 12 steps, Gain from -3dB to +18dB in 8 steps.
- Zebra Pattern indicator for adjusting shutter speed & exposure.
- Custom Preset function lets you preset, store and recall custom settings for color intensity, white balance (bluish or reddish), sharpness and brightness.
- Built-in ND filter cuts down the amount of light, letting you to work in the middle of the camcorder's f-stop range even under bright conditions.

Time/Data Codes

- Stores Photo, Date/Time, Shutter Speed, Iris, Gain and F-stop for easy recall. So if you have to re-shoot, you know your original settings for every scene and frame.
- Records Drop/Non-Drop Frame time code. Time code can be read either as RC time code or as SMPTE time code.

Professional Viewfinder

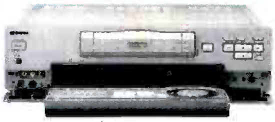
1-inch B&W viewfinder with 550 lines of resolution for easy focusing even in low contrast lighting situations. Also has a separate information sub panel for displaying time code, battery time, tape remaining and other camcorder functions without cluttering up the viewfinder.

Digital Audio

- Records 16-bit/48kHz audio on one stereo track or 12-bit/32kHz with two pairs of stereo tracks (L1/R1, L2/R2), so you can add stereo music or narration.
- One-point stereo electret condenser mic for clear stereo separation. Directivity can be selected from 0°, 90° and 120°. Audio DSP provides wind noise reduction without harsh filtering to maintain audio quality.
- Automatic & manual (20-step) audio level record controls. Monitor audio with headphones or from the LCD panel which has an active VU meter. • XLR input connectors for mics and audio equipment.
- Since audio and video are recorded on separate areas of the tape, you can add audio tracks later and insert-edit video without affecting the original audio track.

DSR-200 Field Package:
- DSR-200 Camcorder • NPA-1000/B Battery Case Adapter
- 3 NP-F930/B 7.2v 4000 mAH Batteries
- AC-V900/B AC Adapter, Triple Battery Charger
- VCT-U14 Tripod Adapter • LC-2000CP System Case

DSR-30 DVCAM Digital VCR



The DSR-30 is Sony's first industrial grade DVCAM VCR. Industry standard 4:1:1 8-bit digital component recording with a 5:1 compression ratio, provides spectacular picture quality and multi-generation performance. This feature packed VCR handles both Mini and Standard DVCAM cassettes for up to 184 minutes of recording time, as well as playback of consumer DV tapes. PCM Digital Audio is recorded at 48kHz (DAT quality) stereo.

Dual Cassette Mechanism

Dual Cassette mechanism allows use of both standard DVCAM and mini size tapes without an adapter.

Digital Audio

PCM (Pulse Code Modulated) Digital audio can be recorded at either 48kHz (16-bit 2 channel) for DAT quality audio, or at 32kHz 12-bit 4 channel) where an additional two tracks of audio can be added over previously recorded portions.

Editing Capabilities

Equipped with Control L, the DSR-30, when hooked up to another LANC -based recorder, is capable of SMPTE Time Code based accurate editing even without an edit controller. Built in editing functions include separate video and audio insert. Or assemble editing with up to ten scenes automatically assembled in any order chosen by the "In" and "Out" points. By searching for either an Index point or Photo Data recorded by the DSR-200 camcorder, the DSR-30 can drastically cut the time usually required for editing. The DSR-30 can record up to 135 Index points on the Cassette Memory thanks to its 16K bits capability.

Audio Lock

Audio lock ensures audio is fully synchronized with the video for absolute precision when doing an insert edit.

IEEE 1394 Interface

DV In/Out (IEEE 1394) connector on the VCR allows digital dubbing of video, audio and data ID with another VCR having this connector, with no loss in quality.

Clear Frame Picture

Using Frame Interpolation technology the DSR-30 can detect motion between two fields within a frame and compensate for picture blur providing a clear frame picture even from moving images.

Built-in Edit Control Unit

Built-in control tray has a jog/shuttle dial, VCR and edit function buttons. The jog/shuttle dial allows picture search at ±1/5 to 15X normal speed and controls not only the DSR-30 but also a player hooked up through its LANC interface.

Backward and Forward Compatible

Analog audio and video input/outputs make it fully compatible with non-digital equipment. Playback compatibility with consumer DV tapes allows you to work with footage recorded on consumer-grade equipment. Tapes recorded in the DSR-30 are also compatible with Sony's high-end DVCAM VCR's.

PVM-14N1U/14N2U & 20N1U/20N2U
13" & 19" Presentation Monitors

With high quality performance and flexibility, Sony's presentation monitors are ideal for any environment. They use Sony's legendary Trinitron CRT and Beam Current Feedback Circuit for high resolution of 500 lines as well as stable color reproduction. They also accept worldwide video signals, have a built-in speaker and are rack mountable. Four models, the PVM-14N1U/20N1U are designed for simple picture viewing, the PVM-14N2U and 20N2U add RGB input and switchable aspect ratio for more sophisticated applications.

They Feature:
- 500 lines of resolution to match DV, DVCAM and DVCPRO recording capabilities.
- Beam Current Feedback for color temperature stability.
- They handle four worldwide color systems: NTSC, NTSC 4.43, PAL, and SECAM.
- Built-in speaker for small audiences without the expense of an external sound system.
- On screen display in five languages. Picture adjustments (chrome, phase, contrast, brightness) and setup adjustments (volume, aspect ratio) are displayed as easy-to-read on screen menus.
- Closed captioning is available with the optional BKM-104 Caption Vision Board.
- Designed with a sturdy metal cabinet for stability, durability and rack mounting. The 13-inch series mount in a 19-inch rack with the MB-502B Rack Mount Bracket. The 19-inch monitors with the SLR-103A Slide Rail Kit.
- **PVM-14N2U/20N2U Only:**
- Remote Control (Last Input Switch) - Contact closure remote control allows you to wire a remote to an existing system so that the monitor's input can be remotely controlled to switch between the last previously selected input and the current input.
- With the PVM-14NU2 and PVM-20N2U Series, the aspect ratio is switchable between 4:3 and 16:9 simply by pressing a button.

PVM-14M2U/14M4U & 20M2U/20M4U
13" & 19" Production Monitors

Sony's best production monitors ever, the PVM-M Series provide stunning picture quality, ease of use and a range of optional functions. They are identical except that the "M4" models incorporate Sony's state-of-the-art **HR Trinitron** CRT display technology and have SMPTE C phosphours instead of P22.

- HR Trinitron CRT enables the PVM-14M4U and 20M4U to display an incredible 800 lines of horizontal resolution. The PVM-14M2U and 20M2U use an aperture grille dot pitch of 0.25mm to offer 600 lines of resolution. M4 models also use SMPTE-C phosphours for the most critical evaluation of any color subject.
- Dark tint for a higher contrast ratio (black to white) and crisper, sharper looking edges.
- Beam Current Feedback Circuit • 4:3/16:9 switchable aspect ratio.
- Each has two composite (BNC), one S-Video and component input (R-Y/B-Y, analog RGB) for flexibility. For more accurate color reproduction, the component level can be adjusted according to the input system. Optional serial digital interface kit BKM-101C (video) and BKM-102 (audio) for SMPTE 259M component serial digital input.
- True multi-system monitors they are equipped to handle four color system signals: NTSC, NTSC 4.43, PAL, and SECAM.
- External sync input and output for synchronization with other equipment. Can be set so that it will automatically switch according to the input selected.
- Switchable color temp: 6500K (broadcast), 9300K (pleasing picture), User preset.(3200K to 10000K).
- Underscan and H/V delay capability. In underscan mode the entire active picture area is displayed, allowing you to view the entire image and check the picture edges. H/V delay allows viewing of the blanking area and sync/burst timing.
- Using color bars as a reference, Chroma/Phase setup mode facilitates the complex, delicate procedure of monitor adjustment. Especially convenient when used with computer-based editing systems.
- On-screen menus for monitor adjustment/operation.
- Parallel remote control and Tally via 20-pin connector.
- Sub control mode allows fine, on-screen adjustment of the center "detent" value of the contrast, brightness, chroma and phase knobs.
- PVM-14M2U/M4U mount in a 19-inch rack with the MB-502B Rack Mount Bracket. The 20M2U/M4U monitors mount with the SLR-103A Slide Rail Kit.

QUICK DIAL 72

SONY

UVW-1600/UVW-1800
Betacam SP Editing Player • Betacam SP Editing Recorder

The UVW-1600 editing player and UVW-1800 Editing Player/Recorder are the other half of the UVW series. They provide the true superiority of the Betacam SP format with sophisticated editing features. They are equipped with RS-422 9-pin interface, have built-in TBC's, and Time Code operation. A variety of inputs and outputs, including R-Y/B-Y component, S-Video, and Composite are provided as well. When controlled from an edit controller with RS-422 capability, the UVW-1600 and UVW-1800 form an excellent editing system. They also offer an easy and economical way to enter the Betacam SP format with all its excellent virtues of superior performance, versatility, and reliability.

All the features of the UVW-1200/1400A *PLUS*—

Built-In TBC

Optional BVR-50 TBC Remote Controller allows remote TBC adjustment. The BVR-50 connects via a D-sub 15-pin cable to the rear panel.

Time Code

The Betacam SP format has an independent time code track so an audio track doesn't have to be sacrificed for time code. Frame accurate A/B roll editing is achieved with LTC time code. Functions like Drop Frame/Non-Drop Frame, FREE-RUN/REC-RUN are easily selected by the setup menu keys on the sub-control panel.

RS-422 Interface

An RS-422 9-pin serial interface is provided for versatile editing system expansion. A host of edit controllers can be used, including the Sony PVE-500, BVE-2000, Panasonic, JVC, TAO, and Videomedia stand-alone, or computer-based edit controllers.

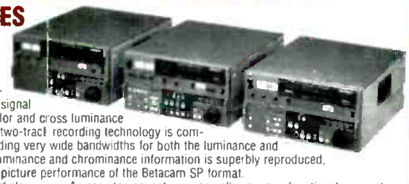
Multiple Outputs

They provide two types of component output through three BNC connectors or a Betacam 12-pin dub connector. The component signal interface allows full advantage to be taken of the superb performance of the Betacam SP format. They also output composite and S-Video. The UVW-1800 features composite, S-Video, component and 12-pin dub inputs as well.

UVW-1800 Only

When connected to an RS-422 equipped edit controller, the UVW-1800 functions as an editing recorder for assemble or insert editing. Frame accurate editing is assured, thanks to the sophisticated servo control and built-in time code generator/reader. In the insert mode of the UVW-1800, video, audio channel 1, audio channel 2, and time code can be inserted independently or in any combination.

PVW-2600/PVW-2650/PVW-2800
BETACAM SP 2000 PRO SERIES



Use of the world standard Betacam SP recording system results in the superior picture quality of the SP 2000 PRO series. Betacam SP is a component recording format in which the chrominance signals (R-Y, B-Y) are time compressed and recorded on one track by using the CTDM system (Compressed Time Division Multiplex). The luminance signal meanwhile is recorded on a separate track so that cross color and cross luminance effects don't exist in the Betacam system. This component two-track recording technology is combined with high frequency FM carriers for each track, providing very wide bandwidths for both the luminance and chrominance signals. The result of all this is that detailed luminance and chrominance information is superbly reproduced, characteristics which create the excellent multi-generation picture performance of the Betacam SP format.

- Performance is further enhanced with the use of metal particle tape. The PVW-2800 uses metal particle tapes exclusively for recording. In playback all three can use both metal particle and oxide tape assuring compatibility with BVW broadcast series Betacam SP VCRs.
- Two longitudinal audio channels with Dolby C - type NR deliver high quality audio with a wide dynamic range, minimum distortion and excellent S/N ratio.
- Built-in TBC's provide stable pictures and eliminate the need for additional correction. Digital dropout compensation also ensures consistent picture performance.
- Remote TBC adjustments can also be done using the optional BVR-50 TBC Remote Controller connected via a D-sub 15-pin cable to the rear panel connector.
- The PVW-2600, PVW-2650 and PVW-2800 (generates as well) read VITC and LTC time code as well as UserBits. LTC can be automatically recorded on the dedicated time code track. Ext/Int time code, Regen/Preset, or Rec-Run/ Free-Run selections are available on the sub-control panel.
- Built-in character generator with output superimposed on the video or monitor output. It displays time code (VITC/LTC U-BIT) or CTL data. VTR function status, can also be displayed by accessing the setup menu. Character display is On/Off switchable from the sub-control panel.
- An easy to use set-up menu allows many functional parameters to be preset. The initial setup menu is scrolled and modified by the search dial while being monitored via video or monitor out.
- RS-422 (9-pin) serial interfaces for versatile editing and flexible system control.
- Picture search provides recognizable monochrome pictures at up to 24X normal speed in forward and reverse. Reproduced in color at speeds up to 10X.
- The PVW-2600 and PVW-2650 both provide two types of component output: three BNC connectors or a Betacam 12-pin dub connector. The PVW-2800 provides two sets (for input and output).
- The PVW-2600 and PVW-2650 also have composite and S-Video outputs. The PVW-2800 has input and output of composite and S-Video.
- Comprehensive self-diagnostics for easy maintenance and servicing. A digital hour meter indicates accumulated time of power on, drum rotation, tape running andnumber of threading/unthreading operations.
- Their control panels can be tilted at up to 90° or be detached from the machine. With optional BKW-2010 Control Panel Extension Kit and BK-803 Control Panel Case offers remote control from up to 15 feet away.
- Optional RMM-110 Rack Mount Kits allow mounting into a 19" rack without taking off the side panels.

PVW-2600
- 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 10X normal speed in forward and reverse (also 24X normal speed in monochrome).
- Two longitudinal audio channels with Dolby C-type NR.
- Equipped with RS-422 9-pin serial interface.
- TBC with high quality digital dropout compensator.
- Optional BVR-50 provides remote control of the TBC.
- 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 DUB connectors, also equipped with S-Video output.

PVW-2650
- Dynamic Tracking (DT) playback from -1 to +3 times normal speed.

PVW-2800
- Built-in comprehensive editing facilities.
- Dynamic Motion Control with memory provides slow motion editing capability.
- More than 90 minutes of playback and record time using L-size metal or oxide (playback only) cassettes.
- Built-in LTC/VITC/User Bits Reader and generator.
- Y/R - Y/B-Y component output via BNC or 12-pin Betacam DUB connectors also equipped with S-Video output.

UHF WIRELESS MICROPHONE SYSTEM

- 800 MHz UHF band is not affected by external noise and interference caused by other wireless systems.
- A PLL (Phase Locked Loop) synthesized system controls the transmission and reception frequencies, allowing stability and easy access to multiple channels.
- Memory back-up recalls the last frequency used when powered up.
- To ensure accurate audio reproduction, the System is equipped with tone squelch circuitry control.
- Wireless channels are preset in each tuner for use in a multi-channel operation at one location. There are 6 channel plans with up to 19 channels for simultaneous multi-operation use.
- All transmitters and receivers are equipped with backlit LCD displays, providing group, battery & AF level status.
- Employs a Compander system for optimum transmission over a wide dynamic range with low noise and interference.
- A space diversity, with two or more antennas used to eliminate noise and signal dropouts.

WRT-810A UHF Handheld Wireless Microphone
- Pll Synthesized Control Transmission
- 8 hours of continuous operation with two AA batteries
- Selectable RF output of either 2.5 mW or 10 mW depending on transmission distance and operating environment.
- Easy-to-read illuminated LCD display of operating channel, battery status, etc.

WRT-830A UHF Handheld Wireless Microphone
- Incorporates an electret condenser mic capsule with unidirectional design.
- Ideal for vocals at film production and broadcasting stations.
- On/Off switch is located inside the body to prevent accidental turnoff.
- PLL Synthesized Control for easy access to all 94 selectable frequencies.

WRT 820A UHF BELT PACK Transmitter
- Accepts all Sony lavalier mics including the ECM-166BC, ECM-44SC/BC, ECM-55 SC/BC, ECM-66 SC/BC and ECM 77 SC/BC. WRT-820A can also be used for wireless guitar applications, using the optional K-1161 instrument cable.
- Backlit LCD information display.
- 8 hrs.of operation with 2 AA batteries.

WRR-820A and WRR-840A Synthesized Diversity Single and Dual Reception Systems
- Employ space diversity reception system to eliminates noise and signal dropout. Diversity reception also assures highly stable reception at greater distances.
- Six channel configurations are factory-preset in the tuners for multi-channel operation.
- Selectable outputs of -60dB, -40dB or -20dB for interfacing with other audio devices, such as mixers, recorders, or amps.
- PLL synthesized tuning control ensures stability and easy access to 94 frequencies.

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Panasonic

QUICK DIAL 74

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 A/B bus
- 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 background colors available)
- Digital effects: strobe, still, mosaic, negative/ positive, paint, monochrome, strobe, trail, and AV synchro
- Real-Time compression - entire source image is compressed inside a wipe pattern
- "Scene Grabber" – move a pattern while 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
- Eight separate memories enable instant recall of frequently used effects
- 8 preset effects including: Mosaic Mix, Position Stream, Corkscrew, Bounce, Flip, Shutter, Vibrate, and Satellite.
- Audio mixing capability of 5 sources with 5 audio level adjustments.

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

QUICK DIAL 72

GLIDECAM INDUSTRIES

V-16 AND V-20 Professional Camera Stabilization Systems

The GLIDECAM V-16 and V-20 Camera Stabilization Systems allow you to walk, run, go up and down stairs, shoot from moving vehicles and travel over uneven terrain without any camera instability or shake. Designed primarily for professional video and 16mm motion picture cameras, the Glidecam V-16 stabilizes cameras weighing from 10 to 20 pounds and the V-20 from 15 to 26 pounds. They are both perfect for shooting the type of ultra-smooth tracking shots that take your audience's and client's breath away – instantly adding high production value to every scene. With either of the "V" series stabilizers you'll be able to offer the type of professional shooting techniques that were previously available only to clients with full budgets. Whether you are shooting commercials, industrials, documentaries, music videos, news, or full length motion pictures, the Glidecam "V" series will take you where few others have traveled.

The Glidecam Support Vest

The lightweight and comfortable Support Vest can be adjusted to fit a wide range of operators. High endurance, closed cell, EVA foam padding and integral T6 aluminum alloy create a vest which can hold and evenly distribute the weight of the Glidecam V-16 and V-20 msystem across the operator's shoulders, back, and hips. For safety, quick release, high impact buckles allow the vest to be removed quickly.

The Three Axis Gimble

A free floating, precision Gimble incorporating Integrally Shielded Bearings creates the super-smooth and pivotal connections between the front end of the Dyna-Elastic Arm and the Camera Mounting Assembly. The Three Axis Gimble provides the operator with finger tip control over fluid tilting, panning and rolling. A locking mechanism allows the Gimble to be placed at varying positions on the Central Support Post. Moving the Gimble effectively adjusts the Systems Center of Gravity. The upper portion of the Sled's central support post includes guide markings. These markings allow for accurate gimble positioning.

The Dyna-Elastic Arm

The Exoskeletal, Dyna-Elastic Support Arm is designed to counteract the weight of the combined camera and Camera Mounting Assembly by employing high carbon alloy springs. The arm may be boomed up and down, as well as pivoted in and out, and side to side. It is the combined booming and pivoting action of the arm which creates the shock absorption necessary for ultra-smooth camera movement and mobility. The spring force is field adjustable to allow for varying camera weights. For safety, a Dual-Spring design is employed to prevent spring failure damage.

QUICK DIAL 74

lowel

ViP Video Lighting System

Designed for video, ViP systems provide 55 to 500 watt capabilities, powered by AC or DC. Mount one on-camera, on-stand, or hand hold it. Some ViPs feature adjustable beam angles. All are light weight and convention cooled.

V-light

Efficient enough to light a small room yet small enough to fit in a large pocket, the V-light provides a broad key light, back light or fill light (with umbrella or gel)
- Extreme wide-angle multi-use halogen source
- Mounts on stand, clamps, boom, wall, window, door-top
- 500 watt, AC powered (lamps not included)

i-light

Battery powered light provides excellent fill light, eye-light, or high-lights, with good contrast control for news and documentary shooting
- Small and lightweight (18 oz.) for on camera use
- Multi-use 6:1 focusing range with i-100 lamp (lamps not included)
- 55 or 100 watt (12/14 volts DC)
- Includes cig. lighter connector or optional 4-pin XLR

Pro-light

Can be used as a low-level key or accent light, fill light (w/diffusion), backlight or background light.
- Multi-use halogen, focusing/tilting controlled with one hand.
- 125 or 250 watt AC, 100 watt 12 volt, or 200 watt 30 volt DC
- Optional cigarette, 4-pin and 5-pin XLR connectors
- Lamps not included

Complete line of Lowel lights, lighting kits and accessories in stock...Call

Tota-Light

Provides a base or bounce light, backlight, or background light. Use it with an umbrella or gel frame with a diffusion kit. It is an ideal fill light or small soft key or illumination for copy work.
- Multi-use halogen source with 360° no-yoke tilting
- Choice of 300, 500, 650, or 750 watt AC lamps (not included)
- Gull-wing reflectors close compactly for storage and travel

Omni-Light

Produces the ideal key or back-light, and with diffusion or an umbrella, it becomes a great soft fill source. With accessories, hand-hold the Omni, camera mount it, or choose from a wide variety of mounting systems.
- Multi-use halogen source provides a non-crossover beam
- Choice of optional quick-change Super-Spot Reflector for exceptionally long throws at all voltages
- Choice of lamps: 420 or 500 watt 120v AC, 650 watt 220/240v AC; 250 watt 30 volt DC; 100 watt 12 volt DC (lamps not included)

DP System

Only 3.9 pounds the DP Light offers a very powerful key, backlight, or background light with or without diffusion. When used with its umbrella or diffusion it provides a soft key, fill, or side light. It includes a #1 reflector for an 8:1 focusing range and a large cool-operating hand grip and knobs.
- Multi-use halogen source with 170° no-yoke tilting
- Choice of 500, 750, or 1000 watts 120 volts; 650 or 1000 watts 220/240 volts (Lamps not included)

anton bauer

Logic Series DIGITAL Gold Mount Batteries

The Logic Series DIGITAL batteries are acknowledged to be the most advanced in the rechargeable battery industry. In addition to the comprehensive sensors integral to all Logic Series batteries, each DIGITAL battery has a built-in microprocessor that communicates directly with Anton/Bauer InterActive chargers, creating significant new benchmarks for reliability, performance, and life. They also complete the communications network between battery, charger and camera. With the network in place, DIGITAL batteries deliver the feature most requested by cameramen: a reliable and accurate indication of remaining battery power.

DIGITAL PRO PACS

The ultimate professional video battery and recommended for all applications. The premium heavy duty Digital Pro Pac cell is designed to deliver long life and high performance even under high current loads and adverse conditions. It's size and weight creates perfect shoulder balance with all camcorders.

- **DIGITAL PRO PAC 14 LOGIC SERIES NICAD BATTERY**
  14.4v 60 Watt Hours. 5 1/8 lbs. 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 TRIMPAC

Extremely small and light weight, the Digital Trimpac still has more effective energy than two NP style slide-in batteries. High voltage design and Logic Series technology eliminate the problems that cripple conventional 12 volt slide-in type batteries. The professional choice for applications drawing less than 24 watts.

- **DIGITAL TRIMPAC 14 LOGIC SERIES NICAD BATTERY**
  14.4 v 43 Watt Hours. 2 3/4 lbs. Run time: 2 hours @ 20 watts, 3 hours @ 13 watts

InterActive 2000 Power/Chargers

QUAD 2702/2401 Four-Position Power/Chargers

The lightest (and slimmest) full featured four position chargers ever. They can fast charge four Gold Mount batteries and can be expanded to charge up to eight. They also offer power from any AC main: all in a package the size of a notebook computer and weighing a mere four lbs! The 40 watt 2401 can charge ProPacs in two hours and TrimPacs in one. Add the Diagnostic/ Discharge module and the QUAD 2401 becomes an all purpose power and test system. The 70 watt QUAD 2702 bundles all Power/Charger features in the ultimate professional power system.

Dual 2702/2401 Two-Position Power/Chargers

The DUAL 2701 (70 watt) and 2401 (40 watt) are sleek, rugged and economical two position Power/Chargers that have all the features of InterActive 2000 technology including DC camera output and LCD display. The DUAL 2701 will charge any Gold Mount battery in one hour, the DUAL 2401 charges ProPac batteries in two hours and Trimpacs in one. Their compact, lightweight package design makes them the ultimate travel Power/Chargers. They can also be upgraded with the Diagnostic/Discharge Module and/or with the Expansion Charge Modules to charge up to six batteries of any type.

PROFESSIONAL VIDEO TAPES

QUICK DIAL 71

Fuji

Professional Grade VHS
PG-30 ... 2.39 PG-60 ... 2.59 PG-120 ... 2.7

Superior Grade Double Coated VHS
SG-30 ... 3.39 SG-60 ... 3.99 SG-120 ... 4.4

H471S S-VHS Double Coated
ST-30 ... 6.99 ST-60 ... 7.49 ST-120 ... 7.9

M221 Hi 8 Double Coated

Metal Particles		Metal Evaporated	
P630HMP	4.99	E630HME	8.3
P660HMP	6.49	E660HME	10.4
P6120HMP	8.49	E6120HME	13.9

M321SP Metal Betacam (Box)
05S ... 17.95 10S ... 18.49 20S ... 19.95
30S ... 22.95 60L ... 31.95 90L ... 49.95

DP121 DVC PRO
12M (Med.) . 8.29 23M ... 9.99 33M ... 12.99
63M ... 22.49 64L (Lg.) ... 23.99 94L ... 33.99
123L ... 43.99

maxell

Hi8 Metal Particle (XRM)
P6-120 XRM ... 6.59

Broadcast Quality Hi8 Metal Particle
P6-30 HM BQ ... 5.39 P6-60 HM BQ ... 6.09
P6-120 HM BQ ... 7.99

P/I PLUS VHS
T-30 Plus ... 1.69 T-60 Plus ... 1.99 T-90 Plus ... 2.09
T-120 Plus ... 2.19 T-160 Plus ... 2.69

HGX-PLUS VHS (Box)
HGXT-60 Plus ... 2.69 HGXT-120 Plus ... 2.99
HGXT-160 Plus ... 3.99

BQ Broadcast Quality VHS (Box)
T-30 BQ ... 5.49 T-60 BQ ... 6.19 T-120 BQ ... 7.39

BQ Professional S-VHS (In Box)
ST-31 BQ ... 7.19 ST-62 BQ ... 7.99
ST-126 BQ ... 8.39 ST-182 BQ ... 17.49

Betacam SP
B5MSP ... 15.75 B10MSP ... 17.75 B20MSP ... 19.75
B30MSP ... 20.75 B60MLSP ... 29.75 B90MLSP ... 46.45

Panasonic

Mini DV Tape
AY DVM-30 ... 9.99 AY DVM-60 ... 11.99

DVCPRO
AJ-P12M (Medium) ... 8.49 AJ-P23M ... 9.99
AJ-P33M ... 13.49 AJ-P63M ... 22.99
AJ-P64L (Large) ... 24.99 AJ-P94L ... 34.99
AJ-P123L ... 44.99

SONY

Hi-8 Professional Metal Video Cassettes
P6-30 HMPX ... 4.59 P6-30 HMEX ... 7.99
P6-60 HMPX ... 6.59 P6-60 HMEX ... 11.49
P6-120HMPX ... 8.89 P6-120HMEX ... 15.49

Hi-8 Metal Evaporated Editor (HMEAD)
E6-30 HMEAD ... 10.49 E6-60 HMEAD ... 14.89
E6-120 HMEAD ... 20.19

PR Series Professional Grade VHS
T-30PR ... 2.39 T-60PR ... 2.59 T-120PR ... 2.79

PM Series Premier Grade Professional VHS
T-30PM ... 3.49 T-60PM ... 3.99 T-120PM ... 4.79

BA Series Premier Hi-Grade Broadcast VHS (In Box)
T-30BA ... 3.59 T-60BA ... 3.99 T-120BA ... 4.79

MQ Master Quality S-VHS (In Box)
MQST-30 ... 7.49 MQST-60 ... 7.99 MQST-120 ... 8.39

BRS 3/4" U-matic Broadcast Standard (In Box)
KCS-10 BRS (mini) ... 8.29 KCS-20 BRS (mini) ... 8.99
KCA-10 BRS ... 8.19 KCA-20 BRS ... 8.69
KCA-30 BRS ... 9.69 KCA-60 BRS ... 13.39

XBR 3/4" U-matic Broadcast Master (In Box)
KCS-10 XBR (mini) ... 8.79 KCS-20 XBR (mini) ... 10.19
KCA-10 XBR ... 9.29 KCA-20 XBR ... 10.69
KCA-30 XBR ... 11.99 KCA-60 XBR ... 15.69

KSP 3/4" U-matic SP Broadcast (In Box)
KSP-S10 (mini) ... 9.59 KSP-S20 (mini) ... 11.09
KSP-10 ... 10.09 KSP-20 ... 11.59
KSP-30 ... 12.99 KSP-60 ... 16.99

BCT Metal Betacam SP Broadcast Master (Box)
BCT-5M (small) ... 12.29 BCT-10M (small) ... 13.99
BCT-20M (small) ... 15.99 BCT-30M (small) ... 16.49
BCT-30ML ... 21.49 BCT-60ML ... 24.99 BCT-90ML ... 37.99

Mini DV Tape
DVM-30EXM w/Chip ... 15.99 DVM-60EXM w/Chip ... 19.95
DVM-30EX "No Chip" ... 12.99 DVM-60EX "No Chip" ... 14.99
DVM-30PR "No Chip" ... 9.99 DVM-60PR "No Chip" ... 12.99

Full Size DV Tape with Memory Chip
DV-120MEM ... 29.95 DV-180MEM ... 34.95

PVD Series Professional DVCAM Tape
PDVM-12ME (Mini) ... 26.95 PDVM-22ME (Mini) ... 26.95
PDVM-32ME (Mini) ... 29.95 PDVM-40ME (Mini) ... 31.95
PDV-64ME (Standard) ... 39.95 PDV-94ME (Standard) ... 44.95
PDV-124ME (Standard) ... 49.95 PDV-184ME (Standard) ... 59.95

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QUICK DIAL 731

TRUEVISION / AVID

TARGA 1000/MCXpress

Professional Video Production Workstation

Incorporating the award-winning TARGA 1000 digital video engine and Avid MCXpress NT non-linear editing software, this fully-configured video production workstation is designed to meet the needs of demanding video production professionals, corporate communicators, educators, training professionals and Internet authors. It includes full screen editing, unlimited compositing and unlimited layering of two video tracks, all from the easy-to-use and intuitive MCXpress NT interface. It also delivers pristine image quality, superior audio-video synchronization, support for NTSC and PAL video standards and composite or S-Video input/output.

TARGA 1000 Features:

Designed for high performance PCs, the TARGA 1000 delivers incredible processing speed for video and audio effects, titling and compositing. With high-speed PCI interface it lets you capture, edit and playback full-motion, full-resolution digital video with fully synchronized CD-quality audio.

- Record/playback video directly to/from hard drive at full frame (50 fields/sec -PAL, 60 fields/sec-NTSC). Video is stored and played back at the highest resolution for each format (768 x 576 -PAL, 640 x 480 -NTSC). Compression can be adjusted on the fly to optimize for image quality and/or minimum storage space. Equipped with composite and S-video inputs/outputs. Also available with component input/output (TARGA 1000 PRO).
- Genlock using separate sync input for working in professional video suites
- Audio is digitized at 44.1KHz or 48KHz sampling rates, for professional quality stereo sound. Since all audio and video processing is done by on-board DSPs, you are assured of perfectly synchronized sound and images.

MCXpress Features:

A powerful non-linear, on-line editing solution, MCXpress for Windows NT is the ideal tool for independent and corporate video and multimedia producers who require predictable project throughput and high-quality results when creating video tapes and digital media content for training, promotional/marketing material, local television and cable commercials, CD-ROM and Internet/intranet distribution. Based on Avid's industry-leading technology, it combines a robust editing functionality with a streamlined interface optimized for ease-of-use. It offers integration with third-party Windows applications, professional picture quality, professional editing features, powerful media management, a robust title tool and a plug-in effects architecture. It also features multiple output options including MPEG-1 and AVI so you save time and money by reusing media assets across a range of video and multimedia projects.

Input

- Delivers 200KB/frame images (3:1) compression using the TARGA 1000 board.
- Supports component, composite and S-Video providing high-quality 640 x 480 or 720 x 486 images –meeting CCIR-601 specifications. Before digitizing, you can turn video and audio on or off, adjust the incoming signal with the built-in waveform monitor and vectorscope, and adjust the levels of the incoming audio (up to 16-bit 44.1 kHz CD-quality). Dial-a-Quality feature lets you meet specific system, storage and delivery needs.

VCR Control

- Offers batch digitizing when used with time code and an RS-422-equipped VCR. Digitize and edit source material at low resolutions, saving valuable hard drive space, then when you're finished, batch digitize at the highest resolution only the material you need for the final version.

Editing Tools

- Display clips in Frame View for storyboarding or Text View, and quickly locate shots using search and sort utilities. Create programs interactively using timeline editing, frame-accurate trimming and full-screen playback. Unlimited compositing, 32 levels of undo/redo and extensive online support help keeps you productive at all times.
- Timeline window (where you create and edit your project) displays two video tracks – the top track is for creating titles, alpha, chroma and luminance keys, transitions and layered effects. Transitions include smooth motion F/X as well as support for Hollywood FX and Boris FX plug-ins. The second track is for your video clips and four audio tracks (A1 to A4). The time line viewer lets you view your project on the computer and video monitor simultaneously so you can watch the actual video output.

Digital Effects

- Over 100 transition effects
- Key effects including alpha, chroma, luma
- Ability to invert alpha channel • Picture-in-Picture
- Color effects including hue, brightness, saturation, blur, posterize, and invert. Smooth motion effects including slow, fast, strobe, freeze-frame, reverse, fit-to-fill

Character Generator

- Embedded in the software is a subset of Image North's Inscriber CG titling software–the industry standard. Create rolling and crawling titles with any TrueType font or imported graphic. Control position, kerning, leading, transparency levels. Also has eight built-in templates

Audio

- Four audio tracks for real-time audio monitoring and mixing (with unlimited layering)
- Two channels of 44.1 kHz audio for I/O
- Real-time audio levels and pan
- Digital audio scrub
- Adjustable digitize gain
- Waveform display in timeline
- Single-track audio crossfades
- Volume controls for entire sequences as well as volume control of channel, track, clip or within clip

Import/Export

- Import and export a range of Windows-based file formats and seamlessly integrate 3D animation, graphics and audio from other sources. Import and export standard Windows file formats including WAV audio and FLC animation as well as over 20 graphics formats. Rapidly exchange full-screen, 24-bit color AVI images between applications on your system. Through OMF Interchange, you can import video and audio files from other OMF-compatible applications such as Avid's Media Composers system or MCXpress for Macintosh, Elastic Reality and DigiDesign Pro Tools.
- When you're finished, print your program to tape in real time or export your project as an MPEG (bundled with Heruis/Pulitzer MPEG encoder) or AVI file for use with any authoring or Internet publishing application.
- *For EDL export, it comes with a separate application called MCXEDL that exports EDL formats (CMX, GVG, Sony) from an MCXpress sequence.*

TARGA 1000/MCXpress Turnkey Systems:

- 300-watt, 6-Bay Full Tower ATX Chassis
- Pentium ATX Motherboard with 512K Cache
- Pentium II- 300 MHz Processor
- Matrox Millenium II AGP 4MB WRAM Display Card
- 64MB 10ns 168-Pin (DIMM) S-DRAM
- Quantum Fireball 6.4GB IDE System Drive
- Seagate Barracuda External 9.1GB SCSI-3 Ultra Wide Capture Drive
- Adaptec AHA-2940UW Ultra Wide SCSI-3 Controller Card
- Teac CD-532e 32X EIDE Internal CD-ROM Drive • 3.5" Foppy Drive
- Altec-Lansing ACS-48 3-Piece Deluxe Speaker System
- Viewsonic G771 17-inch (1280 x 1024) Monitor (0.27mm dot pitch)
- Focus 2001A Keyboard • Microsoft MS Mouse
- Windows NT 4.0 Operating System Software
- Avid MCXpress for Windows NT
- Truevision TARGA 1000 or 1000 Pro Video Capture Card

With TARGA 1000 ....$7495.00
With TARGA 1000 Pro (component input/output) $7995.00

QUICK DIAL 74

CHYRON Graphics

PC-CODI & PC Scribe

Text and Graphics Generator and Video Titling Software

A PC-compatible (ISA bus) board, the PC-CODI incorporates a broadcast quality encoder and a wide bandwidth linear keyer for the highest quality, realtime video character generation and graphics display. A video graphics software engine running under Windows 95/NT, PC Scribe offers a new approach and cost effective solution for composing titles and graphics that is ideal for video production and display applications. PC Scribe lets you use an unlimited number of fonts to create titles and graphics and is designed as an open platform so the feature set is flexible and can be expanded. Combined with the PC-CODI board, PC-Scribe becomes a total solution for real-time character generation with the quality you expect from Chyron. Ideal for use in information displays, broadcast, video production or multi-media applications.

PC-CODI Hardware:

- Standard PC/AT ISA bus interface; 2/3 length form factor
- Fully-antialiased displays • Display & non-display buffers
- Less than 10nsec. effective pixel resolution
- 16.7 million color selections • Fast, realtime operations
- Character, Logo and PCX Image transparency
- Bitstream typeface library selection • Variable flush
- Variable edges, border, drop shadow and offset
- Full position and justify control of character & row
- User definable intercharacter spacing (squeeze & expand)
- Multiple roll/crawl speeds • Automatic character kerning
- User definable tab/template fields
- Shaded backgrounds of variable sizes and transparency
- User definable read effects playback, wipes, pushes, fades
- High quality composite and Y/C encoder
- Integral composite and S-video linear keyer
- NTSC or PAL sync generator with genlock
- Module switchable NTSC or PAL operation
- Software controlled video timing
- Board addressability for multi-channel applications
- Auto display sequencing • Local message/page memory
- Preview output with safe-title/cursor/menu overlay
- Composite and S-video input with auto-genlock select

PC-Scribe Software:

- Uses the entire TrueType library of fonts, so the number of fonts is virtually unlimited. Using the font library also means PC-Scribe can support most international language character sets. Fonts load instantly with no conversion and the level of anti-aliasing applied to characters is selectable.
- Adjust a wide range of character attributes: **Typefaces:** color, size, aspect, rotation, italic, shear. **Edges:** color, size, transparency, softness, position. **Shadow:** color, size, position, drop, transparency, softness
- Wide choice of composition tools. Sizing of text and composition graphics including imported elements is fully interactive and placement is entirely free-form. Graphics may also be layered using cut, copy and paste operations. Multiple preview windows can be displayed simultaneously and the SVGA monitor may be used as an independent preview channel in on-air situations.
- Create a text window anywhere on the screen. Colors and fonts can be picked up off the screen and used for page creation. And a definable safe title marker can be set to ensure viewable video output.
- Import elements to build graphics. This includes OLE objects, iNFiNiT! RGBA, pc-CODI LOGO format, and TGA with alpha channel. Scribe also imports and exports TIFF, JPEG, PCX, TGA, BMP, GIF, CLP, ASCII, IMG, SGI, PICT and EPS formats.
- Dynamic functions including motion effects. Characters, words, rows and fields can color flash and there is an actual digital time clock, as well as an event timer with countup/countdown capabilities.
- Character rolls, crawls and reveal modes. Speed is selectable and can be auto timed with pauses. Messages can be manually advanced or put into sequences along with page transitions. Transition effects include: cut, fade, push, wipe, reveal, hide, cover, peel, zoom, matrix, wipe, spiral, split, weave and jitter.
- Create full screen mattes and color ramps. Horizontal colored bands, with grading, can create sophisticated background designs. Graphic primitives including lines, ellipses, rectangles and arrows can also be used for foreground or background creation. Build layout templates with pre-selected styles and parameters.
- To keep track of elements used in a project, a file can be created to save all font, color, template and user attributes.
- Also features a full screen display mode where text and graphics are displayed raster to raster. Although a software engine, Scribe is tightly integrated with video hardware to maximize display hardware performance. Scribe is optimized for the real time capabilities of PC-CODI's frame buffer.
- Scribe can access and control two different PC-CODI cards installed in one computer. PC-CODI supports both NTSC and PAL and with one NTSC and one PAL card installed can output both standards simultaneously.

PC-CODI and PC-Scribe Bundle 2995.00

LEADER

Manufacturing test and measurement equipment for over 40 years, Leader Instruments is the standard which others are measured against for reliability, performance, and most important—cost effectiveness. Before a product is brought to market, an exceptional degree of energy and effort go into its design. Prototypes are built and tested to withstand environmental and other factors far exceeding actual operating conditions. These include high humidity, extremes of heat, cold, shock and vibration. Manufacturing quality is built in every step of the way and only the finest parts are used. At each production run, subassemblies are separately tested before they are integrated into the finished product, then each product is tested again. This is why less than half of 1% of all Leader products are ever returned for warranty repair or adjustment.

5860C WAVEFORM MONITOR

A two-input waveform monitor, the 5860C features 1H, 1V, 2H, 2V, 1 s/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.

5850C VECTORSCOPE

The 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.

5100 4-Channel Component / Composite WAVEFORM

The 5100 handles three channels of component signals, plus a fourth channel for composite signals, in mixed component / composite facilities. Features are overlaid and parade waveform displays, component vector displays, and automatic bow-tie or "shark fin" displays for timing checks. Menu-driven options select format (525/60, 625/50, and 1125/60 HDTV), full line-select, vector calibration, preset front-panel setups and more. On-screen readout of scan rates, line-select, preset numbers, trigger source, cursor time and volts.

5100D Digital Waveform/Vectorscope

The 5100D can work in component digital as well as component analog facilities (and mixed operations). It provides comprehensive waveform, vector, timing and picture monitoring capabilities. Menu driven control functions extend familiar waveform observations into highly specialized areas and include local calibration control, the ability to show or blank SAV/EAV signals in both the waveform and picture, the ability to monitor digital signals in GBR or YCbCr form, line select (with an adjustable window), memory storage of test setups with the ability to provide on-screen labels, flexible cursor measurements, automatic 525/60 and 625/50 operation and much much more.

5870 Waveform/Vectorscope w/SCH and Line Select

A two-channel Waveform/Vector monitor, the microprocessor-run 5870 permits overlaid waveform and vector displays, as well as overlaid A and B inputs for precision amplitude and timing/phase matching. Use of decoded R-Y allows relatively high-resolution DG and DP measurements. The 5870 adds a precision SCH measurement with on-screen numerical readout of error with an analog display of SCH error over field and line times. Full-raster line select is also featured with on-screen readout of selected lines, a strobe on the PIX MON output signal to highlight the selected line, and presets for up to nine lines for routine checks.

5872A Combination Waveform/Vectorscope

Models 5872A offers all the operating advantages of the 5870, except for the following: SCH is deleted from the 5872A (line select retained), making it ideal for satellite work.

5864A Waveform Monitor

A two-input waveform monitor that offers full monitoring facilities for cameras, VCRs and video transmission links. The 5864A offers front panel selection of A or B inputs, the choice of 2H or 2V display with sweep magnification, and flat frequency response or the insertion of an IRE filter. In addition, a switchable gain boost of X4 magnifies setup to 30 IRE units, and a dashed graticule line at 30 units on screen facilitates easy setting of master pedestal. Intensity and focus are fixed and automatic for optimum display. Supplied with an instruction manual and DC power cable.

5854 Vectorscope

A dual channel compact vectorscope, the 5854 provides precision checkout of camera encoders and camera balance, as well as the means for precise gain/phase adjustments for two or more video sources. Front panel controls choose between A and B inputs for display and between A and B for decoder reference. Gain is fixed or variable, with front panel controls for gain and phase adjustments. A gain boost of 5X facilitates precise camera balance adjustments in the field. Supplied with a DC power cable.

Designed for EFP and ENG (electronic field production and electronic news gathering) operations, they feature compact size, light weight and 12 V DC power operation. Thus full monitoring facilities can be carried into the field and powered from NP-1 batteries, battery belts and vehicle power. Careful thought has been given to the reduction of operating controls to facilitate the maximum in monitoring options with the operating simplicity demanded in field work.

CORPORATE ACCOUNTS WELCOME

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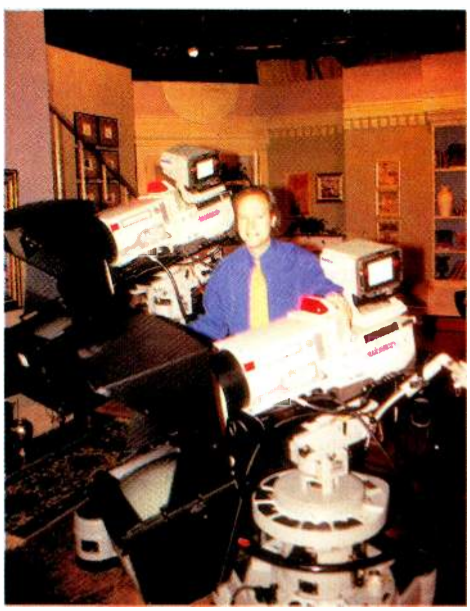
compression products.

Communications Engineering Inc. (CEI) was selected to design and build Hong Kong Telecom's (HKT) digital production studio (DPS) facility. The facility will be used to create the audio and video programming elements used for the channel's identity, interface and promotional material. In addition, CEI designed and built the MPEG-2 encoding suites that prepare the movies and other viewing programs. The encoded program material is then uploaded to HKT's computer servers that interactively transmit to consumer televisions through individual set-top boxes.

Among the integrated solutions within HKT's digital production studio are Quantel's Editbox systems, multichannel Clipbox and Hal Express; Silicon Graphics' Challenge server and High Impact workstation; Chyron's Infinit system; Avid's AudioVision 8 system; Fore Systems' ATM switches; Cisco's Fast Ethernet switch; Minerva's MPEG-2 storage encoding system; DiviCom's MPEG-2 real-time encoding system; Philips BTS Venus and Jupiter routing systems; and Tektronix test and monitoring equipment.

Ikegami announced that Lifetime has purchased three HK-388W ultrawideband digital studio cameras as a continuation in the facility's digital migration. The HK-388W is 16:9/4:3 switchable and features breakthroughs in fully digital signal processing. The camera now brings three generations of full-digital signal processing cameras employing applications-specific integrated circuit (ASIC) technology to the studio. The 388W brings a new level of signal quality and clarity to studio operations with its VLSI chips and 12-bit A/D quantization.



Leitch Inc. is offering free advice for broadcast and production professionals making the switch to digital. The company has developed a seminar and established a hot line on which experts are available during regular business hours to answer any DTV questions. The seminar, Destination Digital, is available free to professional groups and societies in one-hour, two-hour or full-day formats. Groups can schedule a Leitch expert to present the seminar by contacting a Leitch dealer or by calling 800-231-9673, ext. 198.

GlobeCast North America, Culver City, CA, has signed an agreement with Walt Disney World to provide full-time T-1 service between the Disney-MGM Studios in Lake Buena Vista, FL, and the ABC/GlobeCast radio facilities in Los Angeles and New York. ABC/GlobeCast's T-1 service is a digital audio circuit that will deliver signals from on-air personalities broadcasting live from Walt Disney World to the ABC/GlobeCast radio facilities. The signals will then be uplinked and transmitted via satellite to the radio personality's local station.

People

Dwain Schenck, director of corporate communications for Quantel, Darien, CT, has been named the primary press contact for the company's film products and work fulfilled on the Domino by its customers.

James Skupien has been named regional sales manager at NDS' U.S. subsidiary, NDS Americas Inc., Newport Beach, CA.

Michael J. Hennessey has been appointed to the position of vice president, operations, for Chyron Corporation, Melville, NY.

Don Patrican has been named vice president of marketing and sales for the Maxell Corporation, Fair Lawn, NJ.

Gentner Communications Corporation, Salt Lake City, has announced that Francis M. Flood has assumed the role of president of the company and that Brooks Gibbs has been named director of technology and strategic markets.

Kathy Gray has been named project manager at Turner Production, Atlanta.

Extron Electronics, Anaheim, CA, announced the promotion of Judy Cardoz as the northeast regional sales manager. In her new position, Cardoz will conduct on-site visits, product training and new product introductions to the company's customer base.

Edward E. Aslan has been elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for Narda Microwave-East, Hauppauge, NY.

Crown Audio, Elkhart, IN, has named Fred Higgenbottom as senior vice president and general manager of the company and has promoted Mick Whelen to vice president of marketing and sales.

Wold International, Los Angeles, has appointed Joanne Popkin to head its North American business unit, giving her responsibility for ongoing development and management of the company's relationships with its English-language customers in North America and Europe. ■

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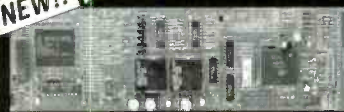

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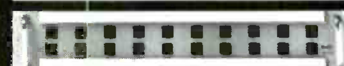

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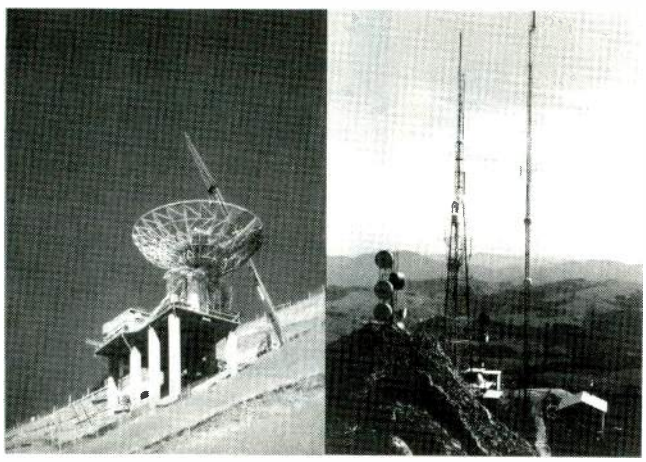

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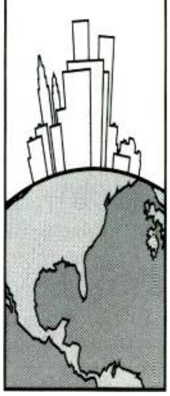

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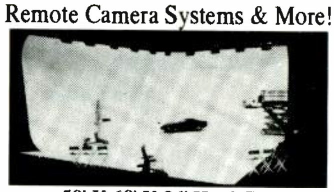

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REMOTE MAINTENANCE ENGINEER Southeast Remote Production Company is seeking a Maintenance Engineer to be part of our Engineering team on large production trucks. Qualifications: 5 years analog and digital solid state electronic experience, 1 year location experience, and display client skills. This position requires extensive travel, overtime and holidays. EEO M/F Send resume: F&F Productions, Attention: Bill McKechney, 9675 4th Street N., St. Petersburg, FL 33702 or Fax: 813/577-5011.

C-SPAN, CABLE SATELLITE PUBLIC AFFAIRS NETWORK, is seeking an Engineer to operate, install, repair and maintain a broad range of television origination and transmission equipment with minimal supervision. Assures high-quality transmissions when stationed both in-plant and at remotes. Drives, operates and sets-up uplink truck. Bachelor's degree, technical degree or equivalent with three years related work experience required. Demonstrated knowledge of installation, operation, maintenance and repair of a majority of television origination and transmission equipment with a broad knowledge of signal flow and routing. Ability to organize and troubleshoot in novel situations. Send resume and salary requirements to: C-SPAN/BE, Human Resources, 400 N. Capitol Street, NW, Suite 650, Washington, DC 20001. EOE

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MAINTENANCE TECHNICIAN WHAS 11 is looking for a maintenance technician with 3-5 years of broadcasting experience to support news department. Main responsibility includes repairing and troubleshooting video tape recorders. Emphasis is in ENG maintenance and with SNG equipment. Component-level repair of recorders and cameras. Ability to maintain Betacam and SX formats necessary. Degree in technical field or equivalent experience required. Send cover letter and resume to: Cynthia Vaughan, Human Resources Director, Human Resources #805, WHAS 11, 520 West Chestnut Street, Louisville, KY 40202. EOE

TRANSMITTER ENGINEER WSBT is looking for an engineer to oversee the operation and maintenance of our AM/FM/TV transmitter site. Ideal candidate will have minimum of five years experience on AM Directional, FM and UHF TV transmitters. Competitive pay and benefits! Send resume and cover letter to Human Resources, WSBT Inc., 300 W. Jefferson Blvd., South Bend, IN 46601. EOE

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STAFF ENGINEER Creative Post & Transfer, Charlotte, NC, a subsidiary of ESPN, has an immediate opening for a Staff Engineer. Candidate should have at least 5 years of experience as an engineer, EIC or maintenance technician at a post production facility or television broadcast facility. Satellite RF downlink/uplink background a plus Facility will move to a new Digital Broadcast Television facility in Orlando, FL November 1999, candidate must be willing to relocate. Send resume to David Whaley at Creative Post & Transfer, 377 Carowinds Blvd., Suite 101, Fort Mill, SC 29715, or FAX resume to: (803) 547-6981.

MAINTENANCE ENGINEER Requirements are a minimum of 2-years' experience in component-level repair of ENG and studio cameras, video recorders (BETA, Hi-8, 3/4), routing and production switchers, etc. The ability to work across departmental lines is a must and you must be able to work all shifts. Transmitter and/or SBE certification preferred. Fax resume: Ann Moss, Station Manager, RNN-TV, (914) 339-0115. E-mail: amoss@rnntv.com. Mail: 721 Broadway, Kingston, NY 12401. No calls please. EOE.

KMIZ-TV AND FOX 11 are expanding again! We have an immediate opening for a Full-time transmitter/studio maintenance engineer. Experience in UHF/VHF transmitters, microwave equipment and computer/LAN system required. Join our team. Send resume to: Personnel Manager, KMIZ TV 501 Business Loop 70 East, Columbia, MO 65201. Equal Opportunity Employer. Benedek Broadcasting Corp.

TRIBUNE BROADCASTING in Houston is looking for a Maintenance Engineer to be responsible for the maintenance of studio equipment. Must be able to repair BETA VTR's to the component level. Will work on construction of new digital TV systems. Computer skills and software knowledge required. Microwave, or ENG experience a plus. Should have technical education or SBE certification. NO PHONE CALLS. EOE. Please send your resume to: KHTV, Attn: Personnel, PO Box 630129, Houston, TX 77263-0129

KOMO (ABC 4) TELEVISION is currently accepting resumes for the position of Broadcast Maintenance Technician. Must have a minimum of 5 years experience. Skills required are broadcast systems troubleshooting and repair of studio A&V equipment, digital equipment, computer systems, ENG equipment, A&V recording equipment. FCC General Class License or SBE Certification desirable. Please send resume to KOMO TV, Human Resources Department, 100 4th Avenue North, Seattle, WA 98109. EOE

IMMAD+ECVS, (www.immad.com / www.ecvs.com) one of the North America's largest combined system integration companies, is seeking both Senior and Mid-level Television System Engineers for our new Boonton, NJ facility. Our growing public company is currently designing and building DTV solutions for the broadcast community and have positions open for the right candidates. The Senior Engineering candidate should have the following: a E.E., and/or P.E.; a strong background in Television engineering; departmental management experience; financial management skills at the project level; computer literate and a working knowledge of Office97/AutoCAD. The Mid-level Engineering candidate should have the following: a good background in television engineering; extensive knowledge of AutoCAD; and computer networking and management skills. An EE or PE would be a plus. Please send all info to Rich Bisignano, at rbisign@immad.com.

ENGINEERING MAINTENANCE PERSONNEL VTE is looking for experienced television remote engineers. If you are interested in working in the field of mobile television and possess at least 2 years broadcast experience in field repair and have at least an E.E.T. degree, please fax your resume to VTE at 1-310-784-0833. Attention Personnel Manager. Or send your resume to the following address: VTE Personnel Manager, 2522 West 237th St., Torrance, CA 90505.

CHIEF ENGINEER KTRK-TV needs a chief engineer with an in-depth knowledge of digital video and audio technology as we begin our conversion to ATV, as well as complete understanding of broadcast and microwave RF technology. Candidates should have experience in TV broadcast engineering management including studio and transmitter facility maintenance, capital project planning and implementation, production and on-air operations, scheduling of technical personnel, preparation of operating budgets, knowledge of all building systems and compliance with all government and industry regulations and standards. We want a team player who has a proven ability to work well with employees and fellow department heads. Degree in a technically-related field or equivalent experience required. Send resume and cover letter (no calls/faxes) to: Henry Florsheim, President and General Manager, KTRK-TV, 3310 Bissonnet, Houston, TX 77005. Equal Opportunity Employer M/F/D/V

WJHL IS SEEKING A MAINTENANCE ENGINEER to perform maintenance on television broadcast equipment, computer and telephone systems. Must be proficient in troubleshooting techniques to repair to the component level. Knowledge of satellite and microwave systems essential. Applicant must be skilled in computer operations using Microsoft applications. SBE certification or General Class License is strongly desired. A minimum 5 years TV broadcast maintenance experience required. Send Resume to: Chief Engineer, WJHL Newschannel 11, 338 E. Main Street, Johnson City, TN 37601. Pre-employment drug testing required. EOE

MAINTENANCE ENGINEER For component level troubleshooting and repair of all broadcast and industrial video recorders; special emphasis on Beta SP; D-2 experience a plus. Some field work required. Must be motivated, self-starter for this excellent opportunity in Southern California. Resume to Classified Ad Coordinator, Broadcast Engineer, Dept. 790, 9800 Metcalf, Overland Park, KS 66212.

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TV CHIEF ENGINEER KOED-TV, Tulsa, is seeking a hands on chief engineer with a strong transmitter background along with studio maintenance experience to be responsible for the transmitter maintenance and supervision of 2 Maintenance Engineers. Need supervisory and organizational skills. 3 years RF broadcast experience required. Great opportunity for someone in an Assistant Chief Engineer position. Send resume and salary history to Personnel, Oklahoma Educational Authority, P.O. Box 14190, Oklahoma City, OK 73113. AA/EEO

MAINTENANCE ENGINEER If you're versed in NTSC & PAL, understand 601 Digital, speak in GHz, can change an upper drum, and trouble shoot to component level, we'd like to talk to you. Immediate opening. SBE Certification preferred. Send resume, compensation requirements, and professional references to: Human Resources, Eyemark Video Services, 310 Parkway View Drive, Pittsburgh, PA 15205. (EEOC) Satellite/Syndication/International distribution.

CHIEF DESIGN ENGINEER for small company. 5 to 10 years experience in video equipment design and manufacturing. Boulder, Colorado location. Experience in both analog and digital television required. Needs to be capable of new product design from concept to production. Salary is commensurate with experience. Fax or Email (NO CALLS) resume to Larry Devereux at 303-440-8878, larryvac@vacbrick.com.

E.I.C. (ENGINEER IN CHARGE) TV REMOTE TRUCK/ENGINEER OPERATOR WXXI Rochester, New York. Supervise and coordinate all technical aspects of remote operations including camera and audio placement and set-up. Requires Associates degree or equivalent experience; minimum five years in remote production with thorough knowledge of production techniques. Maintenance engineering background a plus; valid driver's license and good driving record, CDL Class A Tractor Trailer Driver's License desirable; excellent communications skills and high energy level, ability to work unusual hours and at various locations; ability to work on ladders and other forms of production rigging. Send resume and cover letter to WXXI Human Resources Dept., PO Box 21, Rochester, New York 14601. WXXI is an Equal Opportunity Employer.

BROADCAST ENGINEER THE BOX Worldwide, Inc. seeks an experienced, reliable, self-motivated Broadcast Engineer to assist with management of nationwide LPTV Network. Practical knowledge of TV transmission systems and project management a must. Maintenance experience with ITS, Acrodyne and EMCEE solid state/tube transmitters a definite plus. Extensive travel required. We offer a competitive salary and comprehensive benefits package. Employment contingent upon the successful completion of a drug test and background check. For consideration, submit your resume with salary history/requirements to: THE BOX (EOE), Attn: Broadcast Operations, 1221 Collins Avenue, Miami Beach, FL 33139. Fax: 305-535-8520. e-mail: jesse@thebox.com. No phone calls please.

SR. SOFTWARE ENGINEER -BSEE/CE/CS with 5+ years experience in software design. Responsible for implementation, integration, and system testing. Strong background in formal design using C/C++. Experience required in embedded systems development and real time operating system. Knowledge of video broadcast markets or switching applications is desired. Competitive compensation and benefits package. Send resume to: PESA Switching Systems, Inc., 330-A Wynn Dr., Huntsville, AL 35805 or Fax: (205) 726-9271. EOE.

TV BROADCAST OPERATIONS SUPERVISOR Rochester, New York. Supervise, coordinate, and assign operating personnel for air, audio, videotape editing, remotes and production. Successful applicant will exhibit strong leadership skills, minimum five years television broadcast engineering experience, direct supervisory experience, working knowledge of broadcast rules & regulations, degree preferred. Cover letter and resume to: WXXI, Human Resources Dept., PO Box 21, Rochester, New York 14601. WXXI is an Equal Opportunity Employer.

Viacom O&O in sunny South Florida seeks a **MAINTENANCE ENGINEER** who would like the opportunity to work with the latest technology including tapeless Master Controls operating multiple TV stations. Qualified candidates must have experience repairing and maintaining a TV broadcast/production facility and can trouble-shoot to component level. Facility includes Harris transmitter, Avid Media Composers, Chyron Max, BTS switchers, Phillips media pool, and Sony 1' and BetaCam formats. Experience with UHF transmitters, computer networking, and SBE certification preferred. Send resume and cover letter to: Department ME 211 - UPN 33, 16550 NW 52nd Ave., Miami, FL 33014 EEO

TV ENGINEER OPERATOR II, WXXI ROCHESTER, NEW YORK Responsible for maintaining the high quality of WXXI-TV on-air signal. Work master control, audio, video or videotape for productions. Minimum five years television broadcast engineering experience. Complete mastery and dexterity of operation of master control, videotape, audio production board, video switchers, auto cart machines. SBE Broadcast Technologist Certification or previous FCC General Class. Cover letter and resume to: WXXI Human Resources Dept., P.O. Box 21, Rochester, New York 14601. WXXI is an Equal Opportunity Employer.

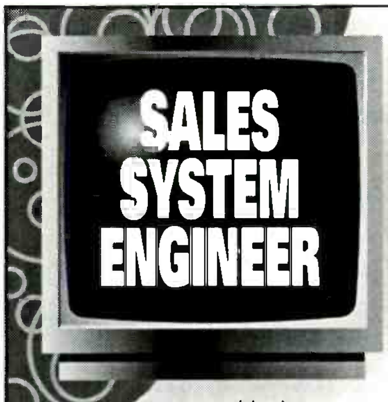
TECHNICIAN MAINTENANCE 2 yrs. exp. in T.V. Must be familiar with ½ in. broadcast video tape machs. Knowledge of microwave & satellite oper's. Will op. satellite news truck, know small cameras (CDD & tube types) should have or qual. for state driver's license. To apply, please send resume to: KOB-TV, Job #06-98, 4 Broadcast Plaza, SW, Albuquerque, NM 87104. NO PHONE CALLS PLEASE! EOE/M-F.

Classifieds Help Wanted

GLOBECAST NORTH AMERICA, a France Telecom Company, and a major provider of transmission services for television and radio broadcasts, seeks self-motivated individuals with minimum 3 years experience for the following positions: RF Staff Engineer: Key responsibilities include maintenance to a component level, installation, calibration and operation of all RF equipment including satellite and microwave transmitters and receivers, satellite and microwave antenna systems, local and remote control systems and audio and data subcarrier systems. This position works regular and additional shifts as required; and must be available on 24 hour emergency basis. Lifting required. A/V Staff Engineer: Responsible for troubleshooting systems and the maintenance, installation and support of all broadcast equipment. Strong knowledge of television equipment and facilities construction. SBE Broadcast Engineer Certification. Strong computer skills required. We offer competitive salaries and an excellent benefits package. Mail or fax resume to T. Bruce at 3872 Keystone Ave. South, Culver City, CA 90232. Fax: (310) 845-3905.

STEP UP TO A BIGGER MARKET... KSMO in Kansas City is looking for an Assistant Chief Engineer. Requires experience in broadcasting maintenance, including systems troubleshooting, repair of studio video and audio equipment, computer maintenance and LAN/WAN operations. UHF transmitter experience preferred. SBE certification and FCC license a plus. Excellent salary and benefits package. Send resume and cover letter to Bob Hardie, CE, KSMO 62, 10 E. Cambridge Cir. Dr., Ste. 300, KCKS 66103 or fax (913) 621-4703. Drug Free Work Environment. EEO M/F

Broadcast ENGINEERING



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- **Hardware Design Engineers (Multiple positions)**
  Design video content production products, including routers, switchers, master control, digital video effects and modular. Requires a BSEE and 4+ years' experience with EPLD, FPGA and DSP design with video systems.
- **Product Marketing Managers (Multiple positions)**
  Develop marketing requirements for specific products/product lines, including HDTV, digital and next-generation routing and production switchers. Develop product concepts, proposals and product positioning recommendations, including pricing strategies. Requires a BS degree and 5+ years' related technical marketing experience, preferably with video content production equipment.

To be considered for Grass Valley openings, mail your resume to: Tektronix, Inc., P.O. Box 1114, Dept. BE/0398/KF, MS N4-2H, Grass Valley, CA 95945, Attn: Ron Marenco; Fax to (530) 478-3808; or e-mail to internet address: ron.marenco@tek.com

Portland, OR Opportunities

- **Hardware Design Engineering Manager**
- **Hardware Engineer - Storage Engineering**
- **Sr. Software Engineers**
- **Software Engineers - Profile Software**
- **Product Development Program Manager**

To be considered for openings in Oregon, mail your resume to: Tektronix, Inc., Corporate Staffing, Dept. BE/0398/KF, MS 48-JOB, P.O. Box 500, Beaverton, OR 97077; fax to: (503) 685-4996; or e-mail your resume to careers@tek.com

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E-Mail address:
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Sue Horwitz
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76345,2624@compuserve.com

EAST
Josh Gordon
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Getting into business

BY PAUL MCGOLDRICK

The scene: The main exhibit hall of the Dallas Convention Center. *The time:* Two days after one of the last NAB conventions held there closed. *The view:* A panorama of a nearly empty convention floor. A few blanket-wrapped booths are waiting for their forklift ride to their homebound trucks, and a couple of stacks of equipment boxes — rental equipment maybe — are awaiting their fate, and one 20x20 booth remains with everything still in place.

A small transmitter manufacturer decided the show had not done anything to help its already perilous position and just walked away from the whole thing, abandoning the booth and all the equipment in it. I often wondered where that equipment went and who invoiced whom for what to clear it away. Certainly, if I wanted to be back in the equipment-making business today, it would be putting out state-of-the-art UHF transmitters; I understand there is a market for a few of them in the next few years!

But what of the rest of the broadcast industry? Is this a good time to take your design talents and turn them into an entrepreneurial success? Fortunately, I was never a good design engineer (I was a great systems engineer) and was never tempted by such a career path. But, I have watched really talented people move into their own businesses and have been struck by their failures and successes. Being nosy I have, of course, tried to analyze what they have done.

There seem to be three different types of startups today in our industry. There is the senior guy who finds himself out of work because the company has been acquired, merged or squashed. He doesn't want to work for someone else again, so he'll do it himself — I'll call him *Mr. Rebound*. Then there is the guy who gets frustrated because his bosses just don't want to listen to him about a direction he wants to take and he's going to do it anyway — that's *Mr. Frustrated*. This last example seems to be the person who is already out on his own and thinks that making something is the shortcut to fortune — I'll call him *Mr. DoBetter*.

Everybody knows these guys, but basically for some reason, and maybe it's the lesson of the bigger company misinterpreted, I have found that Mr. Rebound chooses strange partners. He's usually a really nice guy and most of the time the company fails. Mr. Frustrated often has problems that just don't seem to be left behind and most of the time that company fails. Mr. DoBetter, as an existing bottom feeder, often does quite well, but rarely produces a star operation. However, some companies in each group do survive and do quite well; no, they're unlikely to be a future Sony, but there are niches that companies like Sony don't want to get into and there is money in them for someone else.

Engineering isn't enough

I believe a major problem is that too many startups think engineering, focus on engineering and make engineering edifices. Finding a market niche should not be a "feeling" and should not be a process of finding a niche to fit a technology you want to play with. The basics of broadcast engineering are getting simpler. A major advantage of the "D" in DTV is that a lot more can be done without playing with the signal directly, and there seem to be fewer and fewer of us analog engineers around every year. There is a second stream happening in the electronics world; the movement of video into and out of computers, products like DVD and the overall interest in quality pictures. This has created major shifts at the analog semiconductor manufacturers.

Today, for less than $10 you can buy an encoding IC that is complete with virtually all of the interfaces. They typically offer higher quality than most available OEM products. A 16x16 crosspoint switch can be had for less than $30. Just design (or purchase) a power supply, a box to take all the connectors and you are done. High-quality, off-the-shelf solutions are available for serial too: sending it, receiving it, switching it. The basic, difficult stuff is already designed for you.

Successful companies are those that identify the market opportunity correctly, produce what is needed and know how to sell it in our strange industry.

My take is that if you have been working in the cozy, safe environment of a large company and are tempted by today's market, be really careful. If you have already shown that you can survive the hours, the work, the frustrations, the poverty of such a situation, today may be the time to move in. If you have been in sales through hard times that is good. If you have been in engineering with no sales experience, that is bad. My best bet — if I was to invest in anybody — would be a former distributor who has personally had his future at stake by either selling or not selling; who can manage a small team of development engineers and who was an engineer in a former life. Throw in a supportive, non-destructive family and you have a good chance of making it. Does that sound like someone I know? You bet. ■

Paul McGoldrick is an industry consultant based on the West Coast.

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