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JULY 1998

Broadcast ENGINEERING

THE JOURNAL OF DIGITAL TELEVISION

SPECIAL REPORT: TRANSMISSION TECHNOLOGY

- Selecting DTV transmitters
  Knowing your options
- Transmission line trade-offs
  More power up smaller line

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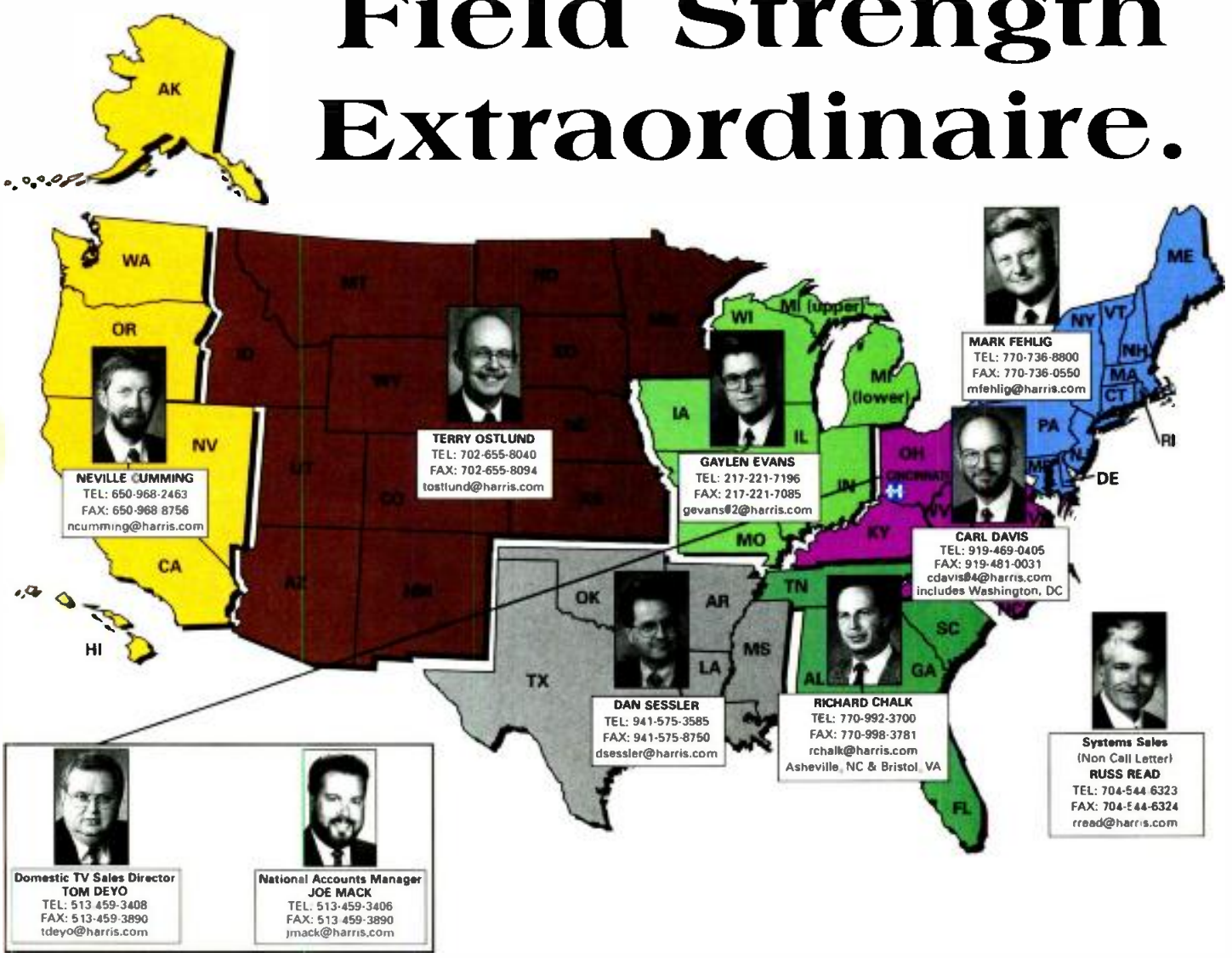

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July 1998
Volume 40
Number 8

Broadcast ENGINEERING
THE JOURNAL OF DIGITAL TELEVISION

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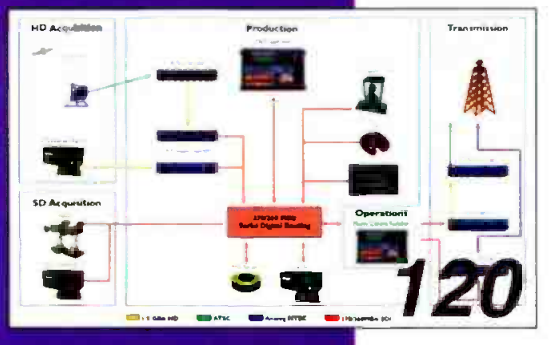

ON THE COVER: *Photo by Doug Schwartz, Sterling Communications.*

Systems Design & Integration

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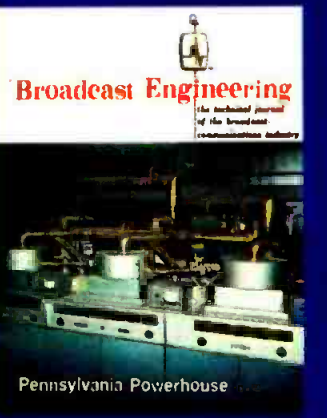
FREEZE FRAME

A look at the technology that shaped this industry.

Do you remember?

This RCA 110kW transmitter helped make WPHL-TV the nation's most powerful station at 4.3 million watts. What year did the system go on the air?



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PHILIPS

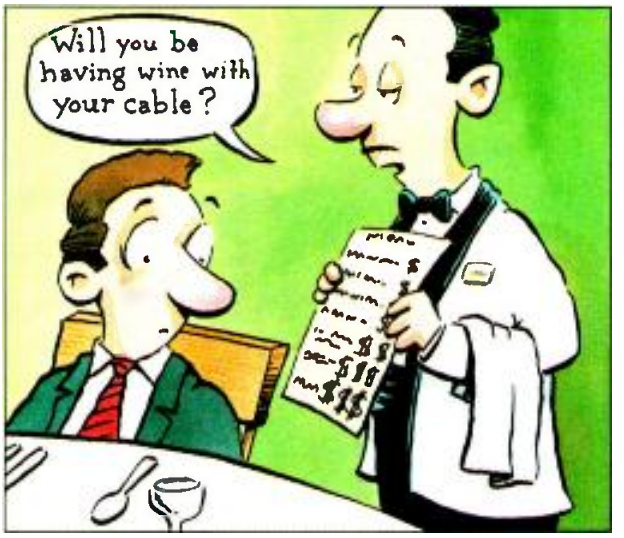
Let's make things better.

Editorial

"The point is that you can't be too greedy"

This quote made by Donald Trump aptly describes the recent deal between AT&T and TCI. Here was John Malone, grinning from ear to ear, as he and AT&T's CEO Michael Armstrong met the press last month to announce their $48 billion deal. AT&T agreed to pay $37.3 billion in cash and stock and to assume $11 billion in TCI debt. Hell, if I were Malone, I'd not only grin, I'd laugh out loud — all the way to the bank. For a guy who became known as a technological visionary, he sure seems to have become materialistic since he last danced with AT&T's former child, Atlantic Bell.

In reviewing the background for this editorial, I read a lot of material, and something important stood out; at no point did Malone or Armstrong emphasize any improved services or lower prices or, God forbid, "more competition." Oh yeah, there were plenty of quotes from outsiders who spun their own opinions into the deal. But, at least in my research, neither company talked about providing new and better services for consumers.



What *was* said is that AT&T would get access to TCI's 10.5 million cable customers; if you include TCI affiliates, that number jumps to 33 million. Not a bad chunk of the nation's 65 million cable homes. And for what purpose? The driving force behind this deal is AT&T's desperation to get a piece of the $100-billion-a-year local phone market. In other words, TCI customers should not expect to see the infusion of capital and debt assumed by AT&T as a sign that their service will get better, but rather that a new phone company may be knocking on their door.

When asked what TCI got out of the arrangement, Leo Hindery Jr., Malone's number-two guy, said that TCI's market share was currently 65%, "My ability to penetrate the last 35% will be much better when I can use Mike's (AT&T's) name. Being able to market local phone service under the AT&T brand name is like Thanksgiving sitting out there. It is stunning." What an egotistical, self-serving, consumer-bashing bunch of crap! Mr. Hindery, you ought to be ashamed of yourself! This whole deal sounds like it's just more of the same — big business scores one and consumers score zero — game over.

What's going to happen is that TCI customers won't see decreased prices or improved services. AT&T customers won't see any similar benefits either. In fact, what's likely to happen is that AT&T will seek rate increases from its current consumers to cover its newly acquired debt. Although all this new capital should at least result in new digital services being quickly brought into TCI homes, that doesn't appear to be likely. If I were a TCI customer, I'd be keeping my eye on the sky (read that as Primestar and DirecTV) for future cost breaks and new services. With increased debt comes higher prices. Ask your bean counter. Increased debt means you have to service (pay off) that debt. It's obvious that the pricing of future AT&T and TCI services is more likely to resemble a bottle of Dom Perignon than anything else.

Brad Dick

Brad Dick, editor

direct: brad_dick@compuserve.com
website: www.broadcastengineering.com

"Trinity is ready to replace a quarter of a million dollar television control room."
— CNN

"My jaw dropped... Trinity proves you don't have to win the lottery to buy real-time effects and a D1 production studio. This from a PC? You bet."
— Digital Video Magazine

"Wow ... Trinity goes far and beyond anything available for sale today in terms of features and price. Trinity's real-time video effects might be considered mind-boggling at any price... this is the system to watch"
— Videography

"A state-of-the-art television studio offering dazzling special effects at a surprisingly low price. Trinity has amazing capabilities... it looked like it was running on a $100,000 system."
— New Media Magazine

"Nothing short of magical... the first true all-digital D-1 video switcher for the desktop... a real winner."
— AV Video

"Innovative real-time effects that really turned heads ... Trinity's CG and paint/compositing programs rival systems at more than twice the price."
— Video Systems

"...rivals the performance of systems that cost hundreds of thousands of dollars."

"functions previously found only in high-end work stations and multi-hundred thousand dollar dedicated production gear... Trinity made the video industry sit up and take notice"

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— BYTE

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— PC Magazine

"...Trinity is enormously impressive, with super-sharp, noiseless video and fabulous effects"
— Digital Magic

...in a word, stunning... Trinity stands poised to revolutionize the desktop video industry."

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— Millimeter

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— Multimedia

"Trinity is awe-inspiring ...one of the most significant and intriguing concepts within the hurricane of products."
— TV Technology

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This tape is available for a limited time only exclusively in North America. Trinity is a trademark of Play Incorporated. Patents pending. Copyright © 1998

Reader Feedback

My digital is better than your digital

I agree with your editorial "My digital is better than your digital." (See May 1998, p. 10.) It's the quality of the programming and not the quality of the broadcast. However, what will happen when one network offers live sports broadcast in higher resolution than a competitor. I've been in pubs where the deciding factor on what game to watch was resolved with the most esoteric reasoning. Perhaps the deciding factor will be broadcast quality. I believe live

events, which equals identical programming, will become the cornerstone of a viewer favoring one format (network) over another. But who am I to judge. I still use a turntable and favor LPs.

CHRIS EDWARDS
TECHNICAL OPERATIONS
ESPN CLASSIC SPORTS

Hey Chris,

Does "Classic Sports" mean you guys do Beethoven and Brahms? Or is "Classic" just old sports figures?

I've been wondering when someone would say what it is, but I didn't think I would see it in a technical magazine. Programming is what counts. Technology is only a solution looking for a need. Without must-carry for cable to help, is digital broadcasting headed for oblivion? And who would expect more from a Washington bureaucracy?

DAVID GROVER
WSU/CTN

You sir, are right on the mark with your editorial. I too wondered what would happen when the TV stations in this area went digital. I wondered if they would repeat the "my radar is better than your radar" war. Yep, it happened here in Orlando. Channel 6 has "Neighborhood Doppler," Channel 9 has "Doppler 9000" and Channel 2 started it all with "Live Super Doppler 2."

KEN OTTO
ENGINEERING TECHNICIAN
WBCC-TV
COCOA, FL

Non-linear: A reality check

Gee, I thought I watched Ken Burns' Civil War documentary on my television. I don't recall it being a theatrical release. Therefore, I would describe a "film maker" as one who produces and creates in that medium. Ken may shoot it on film, but it ends up on video, and in my book, that's television. As a battle-scarred veteran of several non-linear editing systems, I would say Charlie White was right on the money (see "Non-Linear Editing: A Reality Check," May 1998, p. 96).

DENNIS HART
SEMAPHORE VIDEO

In Charlie White's article on non-linear editing, he says that the StrataSphere by Scitex "renders" video. This is not true. It is probably the only system for its price that does not render its layer tracks; instead, it "composites" helping keep the process non-destructive.

STEVE SMITH
LAS VEGAS, NV

Wireless video sender

Dear Mr. Dick:

I would like to see an article on Henry Ruh's modifications to the Wireless Video Sender, including the modifications made and external antennas needed. (See "In response to the October Digital Basics — A TV Station for Less Than $150," Jan. 1998, p. 12). Many of us in the education area would love to teach our students about the wonders of live shots of ENG links but can't afford the $35,000 price tag. Can you help?

Mr. Ruh responds:

The unit is called the Wavecom jr. It is available from ATV Research, 310 Broadway, Dakota City, NE; 800-392-3922 or 402-987-3771.

Planning for the future

Editor:

I would like to know if any kind of assessment tools exist to help determine where your facility engineer is in relation to future (technical) requirements. I have a great broadcast engineer, but am worried about his readiness and ability to transition to the computerized world. Do you know someone who can help consult with us on training?

NAME WITHHELD TO
PROTECT THE INNOCENT

Dear Manager:

I think it's wonderful that you're concerned about the training that will be required for your engineer. My recommendation has always been to look to the Society of Broadcast Engineers (SBE) as the best source for training and education. They maintain the best certification program available and have local chapters. In addition, the SBE has a wealth of technical references, including books, tapes and other training materials. Contact: Society of Broadcast Engineers, 8445 Keystone Crossing, Suite 140, Indianapolis, IN 46220; 317-253-1640.

BRAD DICK
EDITOR AND FORMER SBE PRESIDENT

Send your comments to brad_dick@compuserve or fax 913-967-1905. Also, check out the *BE* web site at www.broadcastengineering.com

Our HDTV Lenses Took The Gold At Nagano.

The Winter Games at Nagano provided many firsts. For broadcasters, it was the first time these events were captured in HDTV. Japan's NHK, could select from their own backyard, some of the best HDTV equipment manufacturers in the world. For lenses, they choose Canon. Great moments like these demand nothing less.

Since being the first to introduce a full line of HDTV lenses, Canon has been the industry source for this important technology. Users comment on the incredible shots, lightweight design, exceptional technology, ease-of-use, and 100% support.

Canon's full line of ENG and Studio HDTV lenses incorporate their world renowned Internal Focus (IF+) technology and include the HJ15X8B IRS/IAS, the world's lightest standard zoom (3.5 lbs.); the HJ18X7.8B IRS/IAS Long Zoom (18X zoom and 7.8mm wide angle); the HJ9X5.5B IRS/IAS Wide Angle Zoom, achieving the widest angle for HDTV lenses; the UJ20X7B Studio lens, with Digital Servo Controls for precise focusing; and the UJ65X9.5B Field Zoom, with the longest zoom ratio in its class. When you're ready to go HDTV, go for the finest HDTV lenses in the world: Canon HDTV Lenses.

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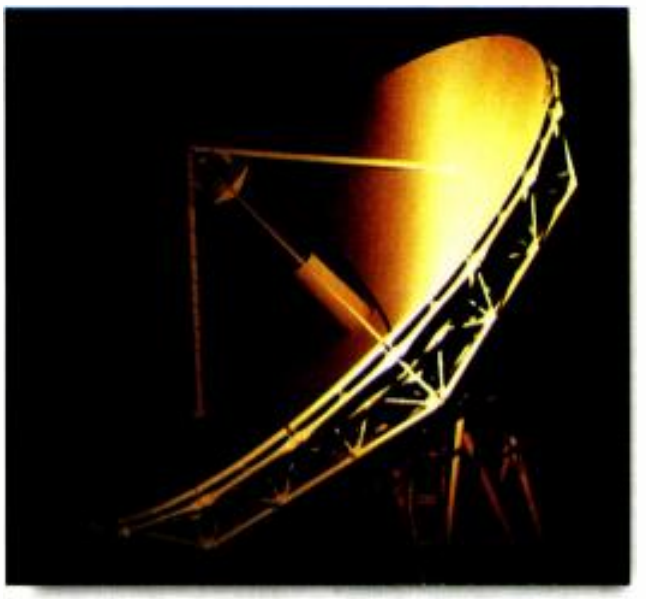
News

500 channels plus video on demand?

BY LARRY BLOOMFIELD

Look out! There's a new kid on the block, Digital Broadcasting Open Video Systems (DBOVS). What could eventually amount to a formidable competitor to cable, MDS (wireless cable) and DBS, this FCC-licensed, Santa Ana, CA-based company plans to conduct test trials by furnishing demo sites in major southern California locations. DBOVS says its equipment will enable the end consumer to experiment with video-on-demand, TV interaction, high-speed Internet, and above all, high definition. Open video systems (OVS) were created as part of the Telecommunications Act of 1996. OVS operators will qualify and grant broadcast/channel licenses to video programming providers. DBOVS plans to offer video-on-demand, interactive programming, regular programming, and to special customers, inventory control and what they are calling solutions.



"Having three terabytes will give users a beginning solution to explore our digital interactive atmosphere," says Jonathan Neubauer, DBOVS's director of marketing.

The idea behind the service is that consumers can stay at home and won't need to go anywhere to rent a movie. This is nothing new. Cable services and direct broadcast satellite services offer this service now. The difference is DBOVS's service is "on demand." DBOVS says, "Just click a remote control anytime, sit back and watch." The key operative word is "anytime," which is not true of cable and satellite services. Want to watch a movie at 9:23 p.m.? Click the remote, and it's on your screen, no waiting.

"In addition, DBOVS plans to have available any content at any time, up to the consumer's desire. Consumers will have available service, such as shopping, Internet surfing, e-mailing, watching regular television, distance learning, tele-medicine or simply talking to someone through your television in full-screen full-motion," said Roy Jimenez, vice president of DBOVS.

In the 1996 Telecommunications Act, Congress sought to eliminate the exclusivity of the telephone and cable companies by structuring a way for them and others to compete in each other's formerly monopolized territories; thus, creating an equal access opportunity for TV channels. According to DBOVS, "This access will grant more, better and different kinds of programming. It would also stimulate competition, keeping prices low and affordable to home viewers."

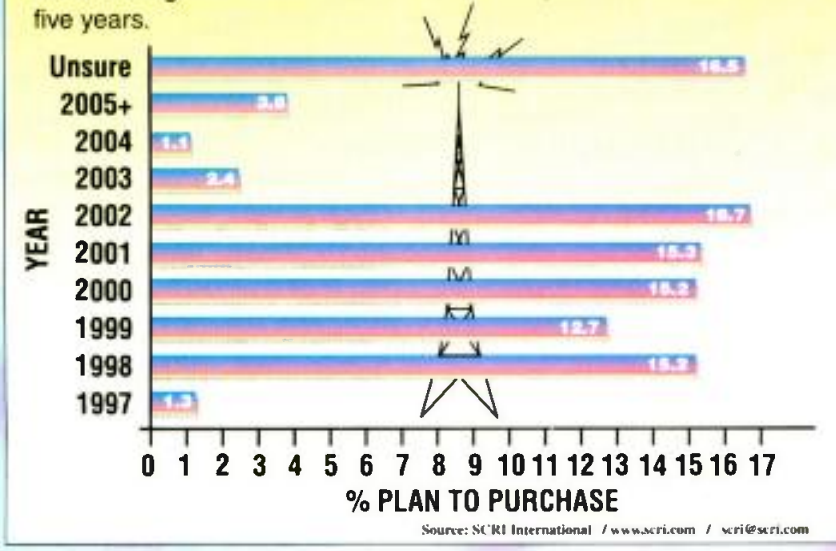
To date, only five applicants have been approved as OVS operators. Four

FRAME GRAB

A look at the issues driving today's technology.

Steady growth seen for HDTV transmitters

Consistent growth seen for DTV transmitters, at least for the next five years.



Down by the Bitstream
Mention Oregon and most people visualize rugged Pacific coastline, whitewater streams, mountains and big trees. Yes, we do have timber (and spotted owls), but Oregon also has a "forest of silicon", where companies design everything from A to P... that's audio to Pentiums™.
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System Two furthers this audio testing tradition with new features designed for testing the digital audio pulse stream, as well as higher audio performance specifications overall:
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❑ Analog Analyzer residual noise ≤ 1.0 μv (-118 dBu)
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❑ Digital analyzer residual THD+N ≤-130 dBFS
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US Toll Free: 1 800 231-7350
apWIN

of them are large telephone companies in the New York and New Jersey areas. DBOVS, a California LLC, is the only licensed OVS operator on the West Coast. "We are certified to administer 500 channels of enhanced broadcast television for the southern California area," said a DBOVS spokesperson.

Here's how they're going to do it. First the OVS will have a large number of DVDs and component VCRs at their main offices as mass storage source devices. Initially, these mass storage devices will be connected through a one-picobit MPEG-II file server that uses fiber channel RAID. With the assistance of a Silicon Graphics' Origin 2000 system using Cray links for video-on-demand, they will deliver the program material you have asked for, via fiber-optic cables to the local phone company. The program will then, in turn, be delivered to your neighborhood via fiber-optic cable to a local hub. From there, it will be delivered via copper wire to DBOVS's decoder box in your home. Each circuit will be a full 6MHz. The broadcasting format will be delivered in a digital TV format. The set-top box will allow the signal to be converted into analog so that existing TV sets will not be outdated. It is up to the home viewer to determine what kind of signal they want to watch.

Jimenez said, "We can deliver any progressive scan program material, at any resolution, to any of our subscribers' TV sets or PCs. We are pioneering this technology. After second quarter '98 testing, we will go forward with those results with plans to have a working system into people's home early in 1999."

A visit to DBOVS's web page is worth the time and effort. For more information on this new competitor to cable, the phone company and DBS, along with a deeper look at the technology behind what DBOVS is doing, check out its web site at www.DBOVS.com ■

Honors well-deserved

Yves Faroudja, founder and chief technical officer of Faroudja Laboratories recently received the prestigious Charles F. Jenkins Lifetime Achievement Award from the Academy of Television Arts & Sciences at the Engineering Awards Presentation in Beverly Hills, CA, for the Development of key patents in video signal processing.

The Engineering Emmy was given to Faroudja for the development of key patents in the arena of NTSC processing, encoding, decoding, enhancement and noise reduction. Faroudja was instrumental in developing the Sony U-matic, S-VHS and Hi-8 video recorders.

In 1991, Faroudja accepted an Emmy for his work on NTSC advancement. Faroudja is a fellow of the SMPTE and a member of ATSC, IEEE and the NAB. He has been honored with the Monitor Award for excellence in engineering, and in 1987 received the SMPTE David Sarnoff Gold Medal Award.

Yves Faroudja

Michael J. Moone, president and CEO of Faroudja commented, "For more than 25 years, Yves Faroudja has pioneered technologies related to video-signal processing and video-image enhancement, earning more than 50 patents.

"With HDTV coming on strong, in the most sweeping change in the history of television, Yves has brought Faroudja into a leadership position right in the middle of the digital revolution. We are proud and pleased that he is being recognized for his considerable achievements by the Television Academy."

Faroudja stated, "Our sole purpose, our passion, all these years has been to deliver the best video-image quality possible in all environments. We have been focused on overcoming the limitations inherent in the way video has been displayed since the beginning of commercial television.

"These limitations, which are common to both U.S. and international television standards, fall into the four general categories that we have addressed: scan lines, motion artifacts, color artifacts and loss of detail.

"Our new line of Digital Format Translators provides a range of modular solutions for broadcasters, cable and satellite services seeking to deliver a variety of Digital Television (DTV) and High-Definition (HDTV) video formats to meet the new HDTV/DTV standards."

Faroudja further noted that broadcast engineers at networks, at station groups and at post-production houses are the people who must solve the dilemma of multiple-format sources and the delivery of FCC-compliant digital signals. It is imperative that stations have a top-quality and flexible solution". ■

The FCC is playing meter maid!

Watch where you park your satellite. If you don't believe me, just ask the folks at EchoStar Satellite Corporation. The FCC has issued a Notice of Apparent Liability for Forfeiture of $20,000 each for operating its two satellites, EchoStar 1 and 2, at locations other than their "authorized" locations. How do you go about explaining to your stockholders that you got parking tickets totaling $40,000? ■

DIGITAL HEADACHE?

DTV Formats

Active Lines	Horizontal Pixels	Picture Aspect Ratio		Picture Rate			
		4:3	16:9	60i	60p	30p	24p
1080i	1920		X	X		X	X
720	1280		X		X	X	X
480	704	X	X	X	X	X	X
480	640	X		X	X	X	X

DIGITAL ASPIRIN

DFT5000 DIGITAL FORMAT TRANSLATOR™

The award winning Digital Format Translator™ line from Faroudja provides the solution to broadcast studios and production houses that need HDTV-like images from interlaced analog and digital sources.

The Digital Format Translator applies patented Faroudja technology to produce HDTV-like images at 480P, 720P and 1080I rates plus complete aspect ratio and image scaling controls.

There is far more to HDTV than just scan rates. Only Faroudja's patented technology can match the stunning quality that HDTV can offer.

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Survival of the fittest!

Most all America is covered by TV signals, one way or another. Until just a few years ago, if you didn't live in an area covered directly by an UHF or VHF full power station, chances are you were able to see your favorite shows via translators or LPTV stations. Even though sets manufactured today won't go there, there's still a translator operating in eastern Oregon on Channel 72. Some areas were, and still are, served via several translator hops. The accessibility in the winter and the costs to maintaining these low-powered devices (typically 10W VHF and 100W UHF), often times, isolated translators, has made them an albatross around the responsible parties' necks.

Hard-wire cable companies have been around for a long time and have helped to fill some of this uncovered area. It isn't always economically feasible, though, to string a cable into some of the more remote areas though. Then there were the wireless cable companies in the 2-3GHz bands.

With the advent of Direct Broadcast Service (DBS) just a few years ago and the excellent picture quality associated with the digital transmission, many viewers in remote areas have switched from their own tall antennas and translator services to one of the several satellite systems now available.

In addition, the FCC's DTV channel assignments have cast a definite cloud over the future of these translators and LPTVs. Many will probably have to go bye-bye in favor of the new technology.

It would appear, however, that all is not lost. Local-to-local television via satellite is on the horizon. If Capitol Broadcasting has its way, they will launch an $800 million satellite that would carry all TV stations in all markets. There is a lot of industry support of this concept. Jim Babb, president of the National Association of Broadcasters (NAB) TV board and vice president of Lin Television, said, "The Capitol proposal is an enlightened look at the situation. This should create an excellent opportunity for broadcasters." NAB put it's full support to the concept in a vote taken during the board's winter meeting in Laguna Niguel, CA.

This is an interesting position because some broadcasters have expressed concern over EchoStar's plans to offer their "local-into-local" service. For openers, EchoStar plans to retransmit the local signals of the four major network affiliates to unserved viewers in Atlanta, Baltimore, Dallas, Detroit, Miami and Philadelphia; and the Capitol approach seems to be much more aggressive. EchoStar maintains that they do not yet have the technical capacity to carry all stations into all markets to which they broadcast, but eventually plan to do so. EchoStar's chairman Charlie Ergen said, "As technology improves, EchoStar intends to invest in additional satellites to deliver local signals in more markets covering a greater number of channels in each market."

Roger LaMay, vice president and general manager of WTXF-TV, in Philadelphia, expressed reservations, "We are not happy about it because we have real concerns about EchoStar's ability to keep people from getting the signal when they shouldn't be." On the other hand, Brian Jones the general manager of CBS's affiliate KTVT-TV, in Dallas, says, "We are happy to provide our signal to anyone who wants to receive it as long as that does not infringe on any other CBS station's market."

If and when Capitol's proposal comes to fruition, it would be legal for satellite companies to retransmit local TV signals into local markets. Stipulations similar to those exposed on cable companies now would have to be enforced, such as must-carry, retransmission consent, network non-duplication and the syndicated exclusivity rules.

Congress has expressed concern with rising cable rates and has encouraged competitive services like satellite broadcasting or DBS. In light of this, and with NAB's support, Capitol believes its legislation has a good chance of passing this year.

Dianne Smith, attorney for Capitol Broadcasting says, "It will take 24 to 26 months to build a satellite from the minute we say go, and we will not say go until we get the legislation. Until that time, Capitol Broadcasting is eating the start-up costs." In the meantime, Capitol is seeking financing for this venture they calling "local TV on satellite."

A scenario similar to these proposals will certainly happen sooner or later. There is no question that with this type of service available, the need for translators will vanish. My question is what impact will this have on the wire and wireless cable companies? ■

Larry Bloomfield, a former chief engineer, is an industry consultant and author located in San Jose, CA.

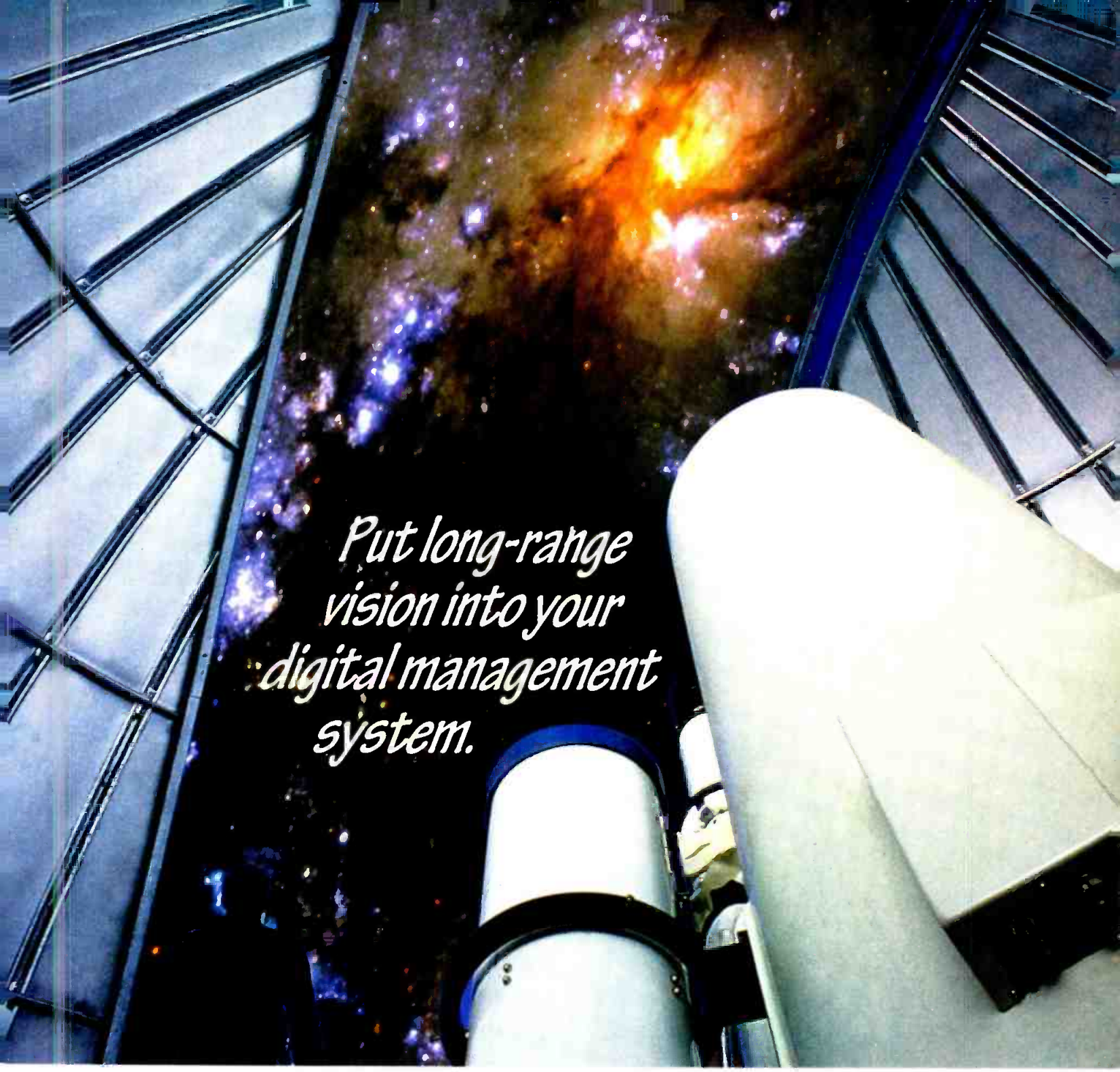
Outside mainstream America: The X Games

BY DEANNA ROOD,
SENIOR ASSOCIATE EDITOR

More than 450 of the world's top alternative-sports athletes gathered in San Diego, June 20 through June 30, to participate in the X Games. Now in its fourth year, the event, which up until two years ago was named the Extreme Games, included competitions for events such as aggressive in-line skating, barefoot jumping, bicycle stunt dirt jumping and street luge super mass downhill.

With its name now abbreviated to the X Games, this year's competitions were staged at three venues located around San Diego. All but three events took place at Mariner' Point — skysurfing took place in Oceanside, and the street luge and the downhill in-line skating competitions took place at Qualcomm Stadium.

The all-sports network, ESPN, covered the event, which was the network's largest remote undertaking. ESPN, ESPN2 and ABC's Wide World of Sports broadcast approximately 37 hours of original programming



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in 177 countries and territories. More than 400 ESPN TV crew members were required to produce and film the games, and another 3,236 people filled volunteer positions. It took 600 man hours alone to build the massive climbing walls used in the sports-climbing competitions.

The ESPN production center was the largest digital production unit used at a sports event to date. The Games also marked the first time that ESPN used non-linear editing systems and a disk-based technology for live-event coverage.

The sports network used fiber optic to network everything in the production-area park, such as intercom interfaces, shared equipment, and even a camera strategically placed on the roof of the nearby Hyatt Hotel for a bird's eye view of the Games. The transmission fiber system tied the broadcast center to all of the venues with 32 audio, eight video, seven intercoms and several data. Telecast Fiber-Optic Systems was used for this fiber-optic network, and with the fiber-optic network, ESPN was able to provide video and communications throughout the park where the Games took place. This allowed anyone on the ESPN crew to communicate with other members of the crew. It also provided the ability to access feeds from the various locations.

To catch action shots at the X Games, approximately 100 camera positions were used, including 30 specialty/point-of-view cameras that were placed on equipment, as well as on the athletes.

The broadcast center was set up like a small village with various production units to cover the 10-day event. The hub of the center was set up at Mariner's Point in close proximity to a majority of the games. An NEP trailer was located in the center of the production area, and video was played back in the NEP trailer, which had seven host-set cameras from the venues. The mobile unit featured several Scitex Abekas products, including Brutus, five DVRs and Dveous for effects. Technical director for the Games, Steve Laxton, said, "Most of the big trucks today are still analog composite, and a lot of component digital gear isn't flexible enough to be fully integrated in an analog composite environment; Dveous and Brutus can interface simultaneously with analog composite and 601, which gives all the advantages of infinite layering and multigenerational performance in a live environment." The truck's CCIR-601 environment combined the Brutus effects system with a Dveous effects system and four Clipstore DDRs, allowing up to 12 images to be processed simultaneously. The Abekas Dveous and A51 DVEs were standard equip-

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ment on many of the other remote trucks.

In the production-area park, the NEP trailer was surrounded by a variety of other production trailers. An event such as the X Games requires an abundance of graphics, and a double-wide trailer housed the graphics production center. Next door to the NEP trailer, five edit rooms were established in the Hyatt Hotel. Four of the five edit rooms had digital Betacam suites supported by Abekas switchers and Dveous effects systems. One of the edit suites located in the Hyatt was an audio sweetening room that was supplemented by a second room with a special sound booth set up for voice-overs. ESPN also rented Sony's Travel Edit Suite, and edit facilities were stationed at each of the three venues.

For rapid turnaround on-line editing of the Games, ESPN used the Tektronix Lightworks V.I.P.4500 non-linear digital editing system. To catch action shots, approximately 100 camera positions were used, including 30 specialty/point-of-view cameras that were placed on equipment, as well as on the athletes. This fully-equipped "point-of-view SWAT team" captured unique angles, such as a view from underneath a skateboard to show the rotation of the wheels. For live action, a Hitachi HV-D3 camera was placed on a gyro-stabilized head and suspended from a CableCam. Via remote control, the camera ran back and forth on a cable that ran between various events, such as the aggressive in-line skating and the BMX bike competitions.

The Sony HDCAM camcorder, HDW-700 and the HDW-500 were also used for skysurfing events, with some cameras located on the helmets of the skysurfers. Using the HDW-700, ESPN downconverted the material to air in NTSC and also edited HDCAM.

The ESPN crew used a Sony HD camcorder to record several of the X Games events, such as bicycle stunt competitions.

For this year's coverage of the X Games, ESPN's goal was to break new ground and offer viewers an innovative and entertaining presentation. The nature of the X Games provided the perfect opportunity to provide this type of coverage. For example, many transitions were used between tape packaged material and live material to achieve the high-energy effect associated with the X Games. The crew experimented with various techniques on the fly and even field-tested new equipment during the production of the Games. The ESPN production crew relied on a variety of Scitex Digital Video's Abekas video post-production equipment to create the looks for the X Games coverage. The result was in-your-face coverage of athletes living on the edge that was viewed by approximately 280 million households.

After two years in San Diego, the search is on for a new location for next year. X Games officials said that by changing locations from time to time, more athletes have a chance to participate. If the X Games stay true to form, next year's Games promise to be even bigger and better with a location yet-to-be announced. ■

Wedding bells for AT&T and TCI

Catching the industry by surprise, AT&T's chairman and CEO, Michael Armstrong, and TCI's CEO John Malone, announced an agreement for a communications-industry deal that could shake up the landscape for many years to come. The nation's largest long-distance company had been a suitor for numerous deals over the last few years, none of which were completed. Likewise, Malone's TCI was the bride at the 1994 Atlantic Bell wedding, but the groom bolted after the cable company's stock fell. This time, both personalities and finances clicked, and a wedding is apparent.

Corporate branding

Under the deal, a new division will be formed, called AT&T Consumer Services. The unit will provide a broad set of consumer communications services — including local, long distance, wireless and international communications, cable television, dial-up and high-speed Internet access services — all under the AT&T brand name.

According to sources, AT&T Consumer Services will own and operate the nation's most extensive, broadband local network platform. Following the merger, the new unit intends to significantly accelerate the upgrading of its cable infrastructure, enabling it to begin providing digital telephony and data services to consumers by the end of 1999, in addition to digital video services. This is where the merger with TCI makes sense. "Today we are beginning

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to answer a big part of the question about how we will provide local service to U.S. consumers," said AT&T's Armstrong. What remains to be defined is how fast those new services can be rolled out.

"This merger is a tremendous growth opportunity for TCI's shareowners and employees," said John C. Malone, chairman and CEO of TCI. "As TCI continues the large-scale deployment of advanced digital set-top devices, AT&T's extraordinary brand and resources are ideal complements to TCI's broadband cable distribution and operations. AT&T Consumer Services will offer consumers a wide variety of entertainment, information and communications products, which thoughtfully address personal tastes, needs, choice and convenience."

AT&T Consumer Services will provide its services to consumers through a combination of its own broadband networks and services it will procure from others, including AT&T. The new unit will include all of the cable TV systems AT&T is acquiring in the merger with TCI, as well as AT&T's fixed wireless technology and related spectrum rights covering more than 90% of the nation. When the merger and pending TCI cable system transactions are complete, AT&T Consumer Services' wholly owned and affiliated cable systems will pass 33 million homes.

Mutual synergy

Through the acquisition of TCI, AT&T Consumer Services will also hold a controlling interest in the @Home Network, a provider of high-speed Internet access and content services. @Home currently has affiliate agreements with TCI and several major cable companies that collectively pass more than 50 million homes.

Both companies talked of the mutual synergy that will result from the deal. The companies anticipate their merger will result in increased revenue and lower costs of about $2 billion per year beginning three years after the merger closes. For example, the merger is expected to improve TCI's cable service penetration and improve customer retention for AT&T's consumer long-distance service. It will also help reduce the charges that AT&T pays to local telephone companies to handle long-distance calls and allow both companies to reduce their respective customer care, billing and advertising expenses. This probably means TCI customers can expect to see the ATT telephone guy knocking at their door in the near term. The phone company has complained loudly for years about the rates it has to pay ROBCs for access to customers. Now those rates can be reduced greatly by using TCI's broadband network for access into the home.

Armstrong said his company "...is now better positioned for growth. When this transaction is completed, AT&T will be the undisputed leader in three of the fastest growing segments of the communications services industry-consumer, business and wholesale networking services." Despite such optimistic statements from it's chairman and CEO, AT&T's share price fell 8.2% to $60 upon the announcement. Meanwhile, TCI's stock rose just over a dollar to $39.75. The cable company's two other trading stocks, Liberty Media Group and TCI Ventures, also gained on the announcement. ■

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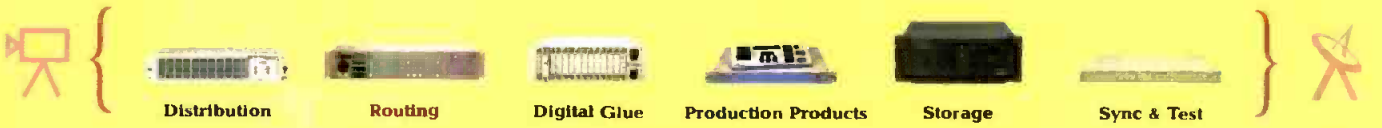

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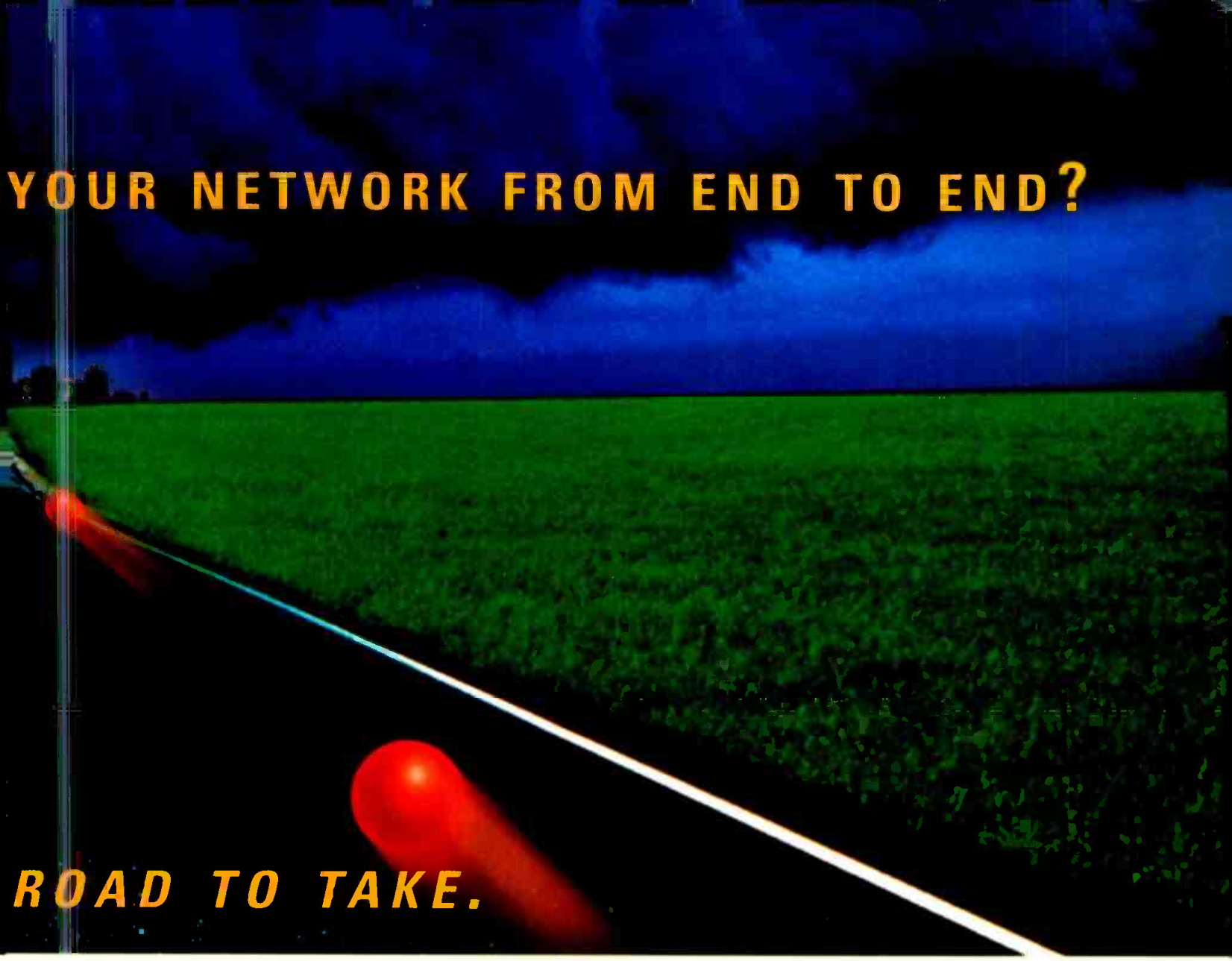

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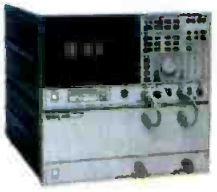

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FCC Update

FCC to audit children's commercial time

BY HARRY MARTIN

The FCC has announced that it will conduct unannounced, off-the-air audits of commercial TV stations. These audits will search for violations of the commission's rules limiting the amount of commercial matter aired during children's programming. Effective May 20, all commercial TV licensees will be subject to this auditing process. The commission has indicated that if violations are found, substantial forfeitures will be assessed.

The FCC's rules limit the amount of commercial matter that can be aired during children's programming to 10.5 minutes per hour on weekends and 12 minutes per hour on weekdays. TV licensees are required to report on their renewal applications whether they have complied with the commission's commercial limit rules.

The new audit program was sparked by the large number of violations of the commercial limit rules reported in the current renewal cycle. The FCC reported that 26% of reporting TV stations could not certify full compliance with the rules. The commission found this level of noncompliance to be "unacceptable."

FCC revokes license

The FCC revoked the license of a Texas station after finding that the licensee made numerous misrepresentations and lacked candor in requesting special temporary authority (STA) to operate from a different site. The misrepresentations involved two different aspects of the STA request.

First, the licensee asserted that it had lost its licensed site. However, at the license revocation hearing, the licensee admitted that the change in site was purely voluntary. Second, the licensee lacked candor about facts regarding the proposed STA site. The new site was so far from the community of license that the station would no longer provide local service and would serve a nearby larger market for the first time. The STA request only provided the coordinates of the licensed site.

In addition, when the FCC's staff advised that it would not grant the STA's request to construct a new tower, the licensee arranged for a business associate to construct a tower adjacent to the site proposed in the STA request. The licensee then amended the STA request to specify use of the "existing" tower.

Further, when providing coordinates for the "existing" tower in the amendment, the licensee referred to the coordinates specified in the initial STA request, inferring that the "existing" tower was only 0.25km from the licensed site. In granting the STA, the FCC relied on the 0.25km variance, and the licensee did not tell the FCC that it was incorrect. When the FCC discovered the errors and rescinded the STA, the licensee made further deceptive and evasive responses.

In revoking the license, the FCC held that neither the station's meritorious programming nor the licensee's prior unblemished record could mitigate serious deliberate misconduct. The commission emphasized that honesty and trustworthiness are fundamental obligations of commission licensees.

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Table 1. New filing fee schedule.

TV translator/LPTV displacement applications

The commission is now accepting "displacement" applications on a first-come-first-served basis for TV translator and LPTV stations displaced as a result of the recently adopted DTV Table of Allotments and by the reallocation of Channels 60-69 to non-broadcast services. Licensees and permittees subject to displacement should act quickly to avoid being forced off the air.

Filing fees to increase

Increased FCC filing fees for many applications and other filings are scheduled to go into effect Sept. 21. Although most fees have increased, the filing fee for annual ownership reports has not changed ($45/station). Filing fees for the more common filings by broadcasters are listed in Table 1. ■

Harry C. Martin is an attorney with Fletcher, Heald & Hildreth, P.L.C., Rosslyn, VA.

Dateline

On or before Aug. 3, commercial TV stations in North Carolina, South Carolina, Illinois, Wisconsin and California must file their annual ownership reports.

Also on Aug. 3, TV, TV translator and LPTV stations in California must file their 1998 renewal applications. TV translators and LPTVs in Nebraska and Kansas also must file by Aug. 3.

TV, TV translators and LPTVs in Alaska, Hawaii, Oregon and the Pacific Islands must file their renewals by Oct. 1. TV translators and LPTVs in Iowa and South Dakota are also subject to the Oct. 1 renewal filing deadline.

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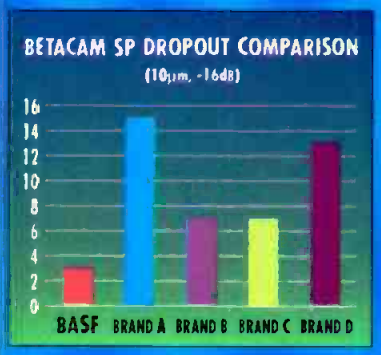

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DTV Update

No space for DTV

BY LOUIS LIBIN

Electronic newsgathering is one of the crucial requirements for a new terrestrial broadcast service. Dating back to 1987, the FCC, along with the FCC Advisory Committee on Advanced Television Services, analyzed spectrum allocations that could impact the non-broadcast services associated with the implementation of an advanced TV service. Regarding the microwave spectrum, the FCC Advisory Committee specifically recommended that new spectrum should be assigned for broadcast auxiliary.

The Advisory Committee also made specific recommendations on new spectrum locations. Broadcast auxiliary use of spectrum (BAS) in most medium-sized markets is highly congested. The reality is that in the beginning of the transition, before most stations originate local news specifically for the channel, the demand for BAS spectrum may be only slightly greater than it is today. However, as broadcasters begin DTV newscasts, BAS usage will increase, and it will probably coincide with a further decrease in available spectrum.

BAS applications

BAS is used by TV stations to convey their signals on a point-to-point basis. Its primary uses are for STLs, intercity relays (ICRs) and electronic newsgathering (ENG).

The non-broadcast video transport falls into two general categories. The first group of services provides contribution transport over the path from the source of the program signal to the studio. Temporary microwave pickup, ENG, network-to-studio feeds and fixed microwave repeaters are examples of contribution transport services. The second category involves distribution transport over the path from the studio to the viewer. Distribution networks include feeder services, such as PMRS, OFS, STL and CARS, and broadcast services, such as DBS, ITFS and MDS. For STLs, the least expensive solution requires total simulcast. Equipment manufacturers will produce radios specifically for the 20Mb/s DTV datastream. Using 16QAM modulation, it would fit within 2GHz or 7GHz channels. At the transmitter site, you would feed the data directly into the DTV transmitter and downconvert one of the DTV programs to feed the simulcast NTSC transmitter. If a station wants to use different feeds, but use the same microwave channel, a 7GHz channel is wide enough for a typical 45Mb/s (DS3) digital radio. You can multiplex a DTV 20Mb/s signal and a slightly compressed 20Mb/s NTSC program within this datastream. You will need to relicense the channel for this use. Manufacturers may need to have their equipment type accepted in this band.

In the present environment, there is no provision for the possibility of new spectrum for broadcast auxiliary spectrum.

Broadcasters currently conduct broadcast auxiliary operations in the 1,900-2,110MHz band (six channels of 17MHz and one channel of 18MHz). In March, 1997, the FCC reduced this allocation by 15MHz and forced broadcasters to relocate to the 2,025-2,130MHz band (seven channels of 15MHz) by the year 2000. Mobile Satellite Service (MSS) licensees have to pay for the relocation. While the MSS participants were pressing for reconsideration, Congress caused the issue to be "overtaken by events." The Balanced Budget Act of 1997 requires the FCC to auction much of this spectrum by 2002.

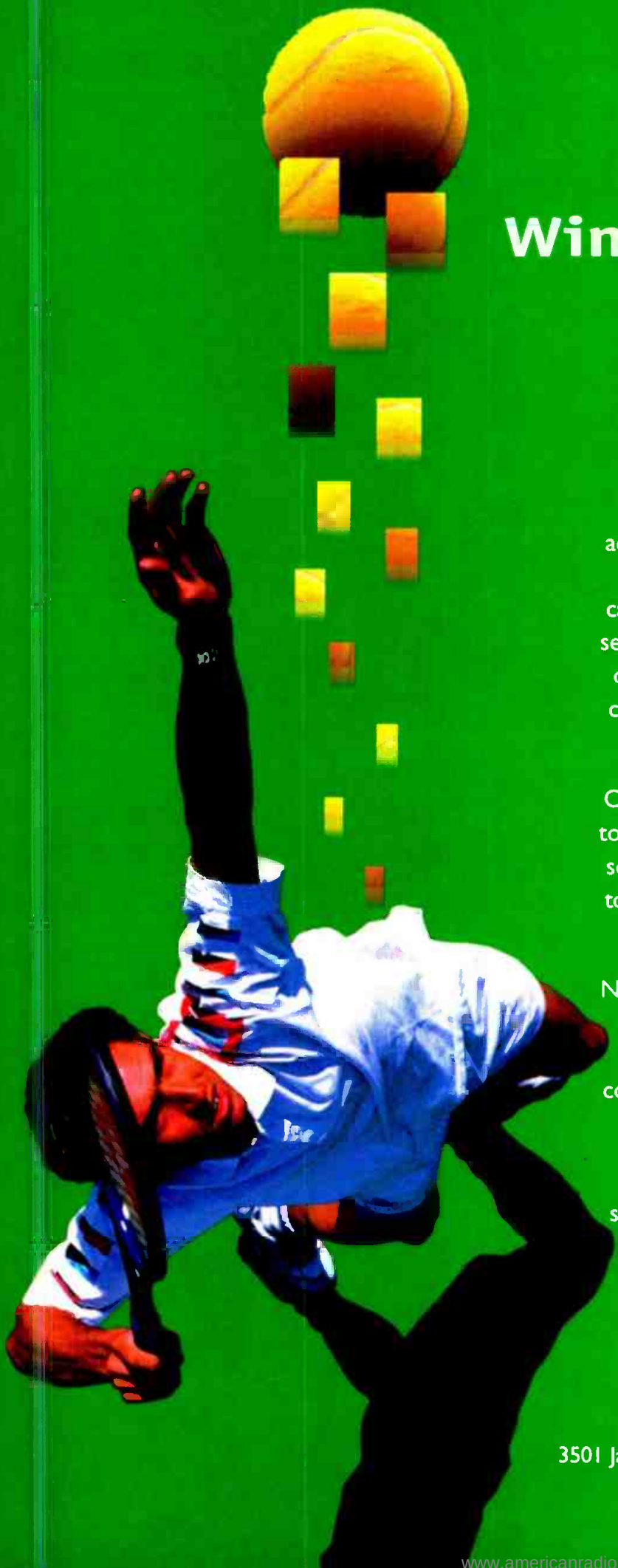
Distribution channels destined for terrestrial VHF/UHF broadcast sites should require infrastructure transport bandwidth commensurate with that required by the 8VSB system. The cost of duplicate transport and the need to conserve spectrum may dictate that DTV-to-NTSC conversion take place only at the transmitter site. Of course, this option is only available when programming on both systems is identical. Distribution to destinations other than terrestrial VHF/UHF broadcast transmitters may require significant additional bandwidth depending on the capability of the final segment of the delivery system. For example, transport of DTV signals to cable or DBS head-ends will probably require additional bandwidth.

Auxiliary spectrum status

Broadcasters' auxiliary spectrum continues to be successfully targeted by many. The FCC recently amended the rules for Parts 74, 78 and 101 regarding auxiliary broadcast services requiring permanent coordination criteria between this service and government operations in the 17.8 to 19.7GHz. This is not an isolated incident related to broadcast auxiliary spectrum.

It is clear that at least in the major markets, new and innovative STL and ENG solutions will be required. In many cases, broadcasters already have set their preliminary plans, and this includes transmitting multiple programs at the same time. This means additional BAS circuits will be required and they do not exist. The reality is that new BAS spectrum should be pursued at the present time. In the present environment, however, there is no provision for the possibility of new spectrum for broadcast auxiliary spectrum. However, there are new technologies available to assist and alleviate the spectrum congestion. ■

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



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Interactive TV: Real or hype?

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Steven M. Blumenfeld, Director, Business Alliance, GTE Interactive Media

Our viewers will start to become "users." They will use the information we broadcast to enrich the viewing experience and to gain additional satisfaction from increased data. The users will not only have choices of viewing, but will be able to tailor the viewing and information available to them. With so much available, the role of the broadcaster will be to become a filter. The users will look to us to simplify their choices. In other words, the broadcaster will portray a certain viewpoint, and a user will subscribe to that viewpoint. An example: user A may believe in the Disney philosophy and therefore subscribe to the Disney filter. On the other hand, user B may be more aligned with *Seventeen* magazine. Our users will most likely have multiple filters.

So how does this new way of looking at our viewers change our jobs? First off, we will start hiring a different type of employee. Information management and social scientists will start penetrating the management of broadcast facilities. With this, we will see a beefing up of our data-research staff, and we will rely on them to set the tone for our users. Our much trusted video engineers will give way to data engineering talents.

Words like dispersion and fusion splicing will become common place in our vernacular. Dispersion is the cause of bandwidth limitations in a fiber and causes a broadening of input pulses along the length of the fiber. Fusion splicing is a permanent joint accomplished by the application of localized heat sufficient to fuse or melt the ends of the optical fiber, forming a continuous single fiber. We will hire network engineers with specific knowledge in ATM, routing and switching. Interactivity means opportunity and challenges for broadcasters. We just need to perceive them in that light. ■

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With the move to digital broadcasting, many broadcasters are evaluating the deployment of interactive TV infrastructures. Along with the promise for new and exciting content, interactive television presents the opportunity to create new business models based on innovative revenue streams.

On the viewing side, TV audiences will now be able to access a wealth of entertainment, information and opportunities using their familiar remote control. They can bank, shop, browse the Internet and find out more about a new car. They will be able to play along with their favorite game show and win prizes without leaving their living room. The possibilities are virtually endless.

Dr. Dov Rubin, Vice President & General Manager, NDS Americas Inc.

Predictably, initial adoption of interactive television will come from advertisers. They will derive clear returns from access to more targeted prospects and the ability to capture the audience's attention for the duration of the controlled message through viewer involvement.

The types of interactive ads that are expected to be most popular include *product information ads* that allow viewers to receive detailed information about a product, *incentive ads* that reward viewers for watching and *targeted ads* that target specific markets. However, no matter how attractive interactive programming appears, broadcasters must undoubtedly weigh the associated costs and expected ROI for deploying the new technologies. Although it's impossible to absolutely qualify the increased business opportunity that interactivity will produce at this early stage of digital convergence, the cost of existing deployment methods can be easily investigated. The enabling technologies to deploy interactivity already exist. These core technologies offer broadcasters the ahility to provide advertisers with a host of services.

Digital television has arrived. With it, interactive functionality promises many benefits. Broadcasters will benefit from new business models that increase revenue opportunities; content providers will attract larger numbers of viewers; and advertisers will parlay interactivity into increased demand, sales and brand equity. ■

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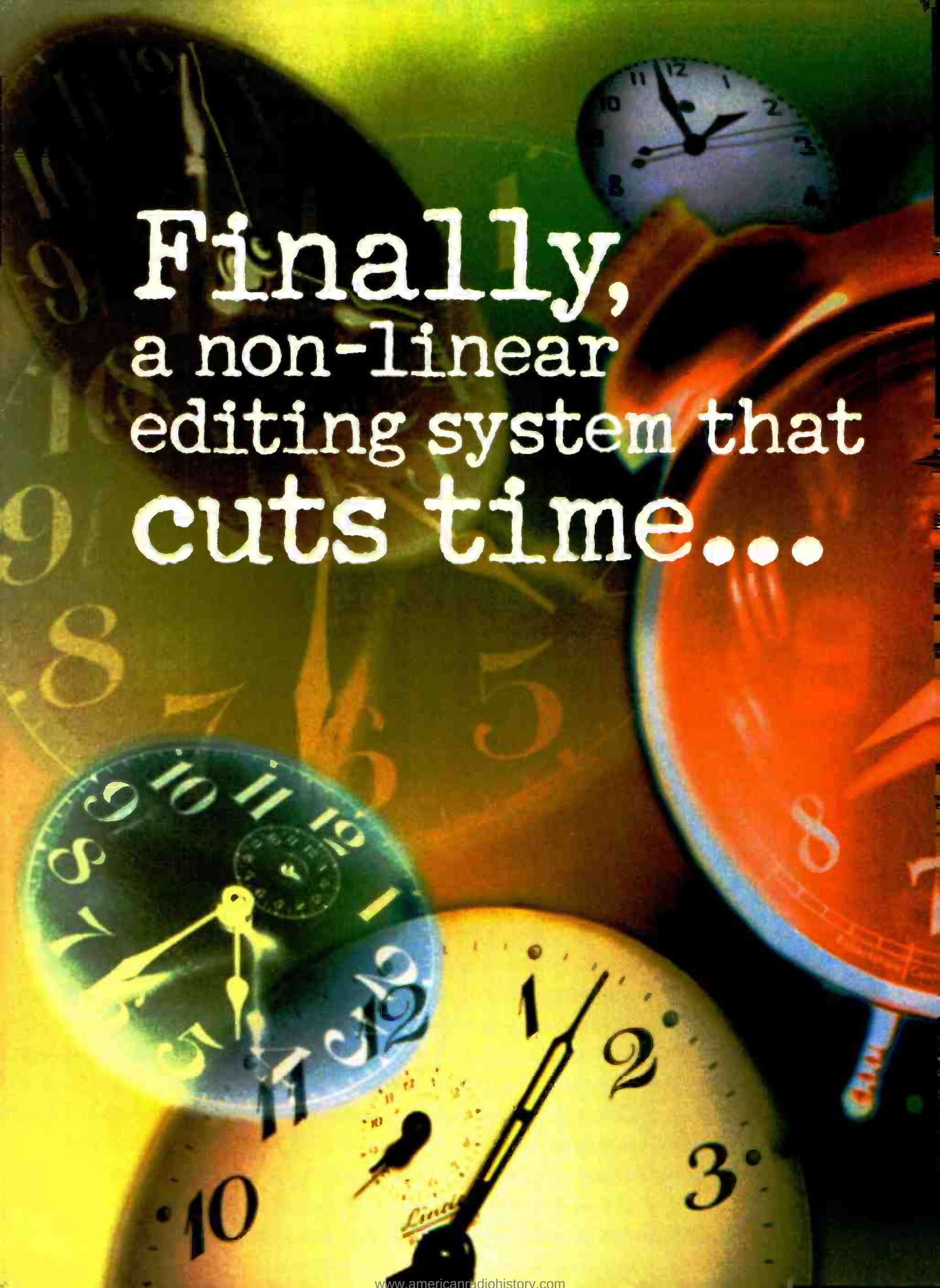

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Transition to Digital

Audio levels and metering in digital and hybrid environments

BY MICHAEL ROBIN

In recent years, digital audio recorders have almost completely replaced conventional analog recorders. In many cases, these digital machines are installed in otherwise analog audio environments, resulting in a considerable improvement of the audio quality. This article deals with some audio-signal level constraints typical of analog and hybrid environments.

Dynamic range

In audio environments, the overload level, also called maximum operating level or maximum output level (MOL), is usually defined in terms of acceptable total harmonic distortion (THD). Although there is no universal agreement on the maximum accepted value for THD, 1% is generally quoted for audio consoles and distribution amplifiers. Analog audio equipment is adjusted such that the MOL is higher than the standard operating level (SOL). The difference between MOL and SOL, expressed in dB, is called headroom.

The MOL of an audio console or audio distribution amplifier is usually specified as 10dB or more above the SOL. Higher values of headroom may be needed when VU meters are used for audio-signal level monitoring. Audio mixing consoles are also specified in terms of maximum input level (MIL). The MIL of an audio mixing console is the microphone input level at which the THD caused by the microphone input pre-amplifier is 1%. The input headroom of an audio mixing console is the difference between the MIL and the rated input level (e.g., -60 dBu). Input headroom specifications for audio consoles are between 20dB and 35dB.

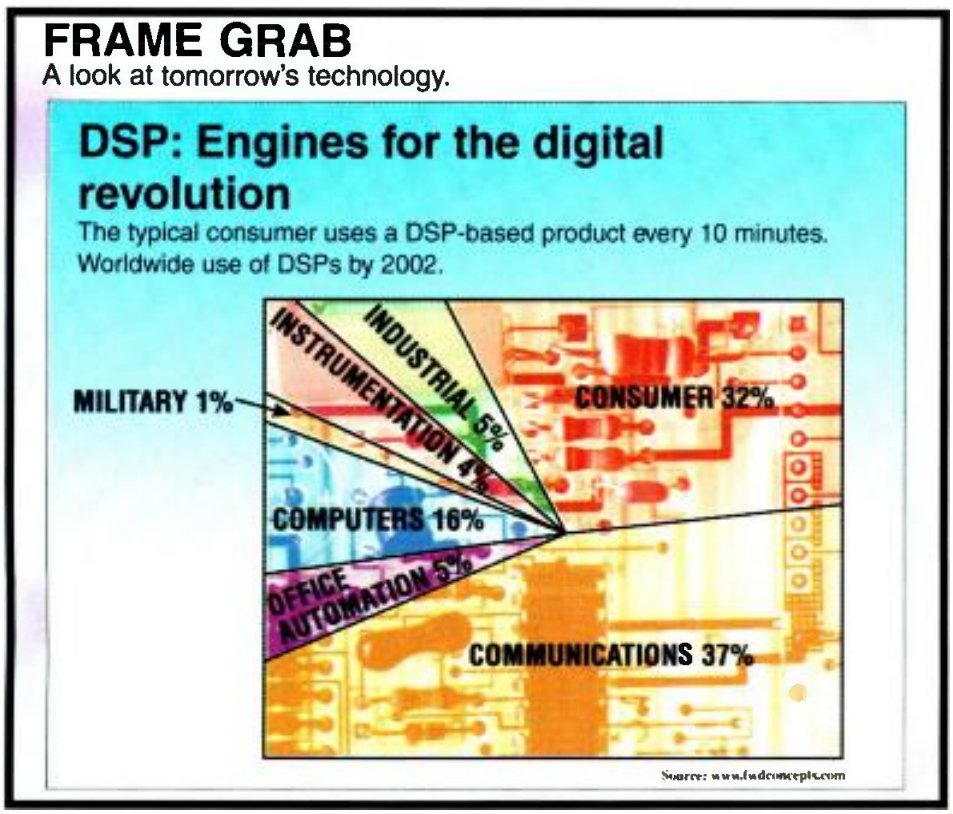
The minimum acceptable signal level in a system is closely related with the acceptable SNR at low signal levels. This is clearly an operational decision. Ideally, the SNR at the lowest acceptable signal level should not be lower than 40dB. Table 1 lists the theoretical SNR at a standard dynamic microphone output for several sound pressure levels (SPL) under open load conditions. This table shows that 40dB SNR can be achieved at an SPL of 61dB, assuming ambient noise in the studio is 0dB SPL. Higher ambient noise levels will raise the minimum acceptable signal level.

The dynamic range is defined here as the difference, expressed in dB, between the MOL and the minimum acceptable signal level. Figure 1 shows how three basic elements, namely the microphone, the studio and the analog audio mixer, each contribute to a reduced dynamic range in a studio. This is based on several assumptions:

- The microphone source resistance is 150Ω.
- The microphone sensitivity is -80dbV @ 74dB SPL.
- The recording studio ambient noise is 30dB SPL.
- The peak SPL is 120dB.
- The studio operates in a voltage-matching mode.
- The SOL is +8dBu.
- The audio mixer MOL @ 1% THD is +18dBu.
- The audio mixer SNR is 80dB with respect to MOL.
- The audio mixer is set up such that an SPL of 120dB produces MOL at the output.

These assumptions reflect the expected single-pass performance of typical equipment available on the market. These are ideal operating conditions, but in actual practice, the results may be different and possibly worse.

Given SPL peaks of +120dB, an ambient acoustical studio noise level of 0dB SPL and a standard dynamic micro-



phone as defined above, the theoretical dynamic range at the microphone output is 59dB, limited mostly by the thermal noise of its resistive component.

The ambient noise in a broadcast studio is on the order of 30dB SPL. This limits the dynamic range of the studio to 50dB. Unlike the random noise generated by the resistive component of the microphone, the studio acoustical ambient noise has mostly low-frequency spectral noise components.

The top-of-the-line analog audio mixers have an SNR on the order of 80dB with respect to the reference MOL. If the mixer is adjusted such that SPL peaks of 120dB generate output level peaks (MOL) of +18dBu (10dB above an SOL of +8dBu) at 1% THD with an SNR of 80dB, the mixer background noise level is -62dBu as measured at its output. This limits the dynamic range of the audio mixer to 40dB.

To avoid mixer input and output overloading at high SPL levels and a reduced SNR at low SPL levels, the operator "rides the gain," manually adjusting input signal levels, channel gains and the master faders to achieve optimum operating conditions. Some mixing audio consoles with a large number of microphone inputs feature individual input channel compressors to ease the operator's task.

Audio recorder dynamic range

Figure 2 shows a comparison between the performance of a typical analog audio tape recorder and a 20-bit digital audio tape recorder.

Analog ATRs: The MOL of analog audio tape recorders is the output level at which the total harmonic distortion (THD) caused by the recording/playback process is between 1% and 3%, depending on the class of the equipment. The MOL of a typical analog audio tape recorder is usually 6dB above the SOL at low and medium frequencies (<1,000Hz). Inevitably, especially when the signal-level monitoring at the output of the audio mixing console is carried out using VU meters, the audio tape recorder may be fed signals with

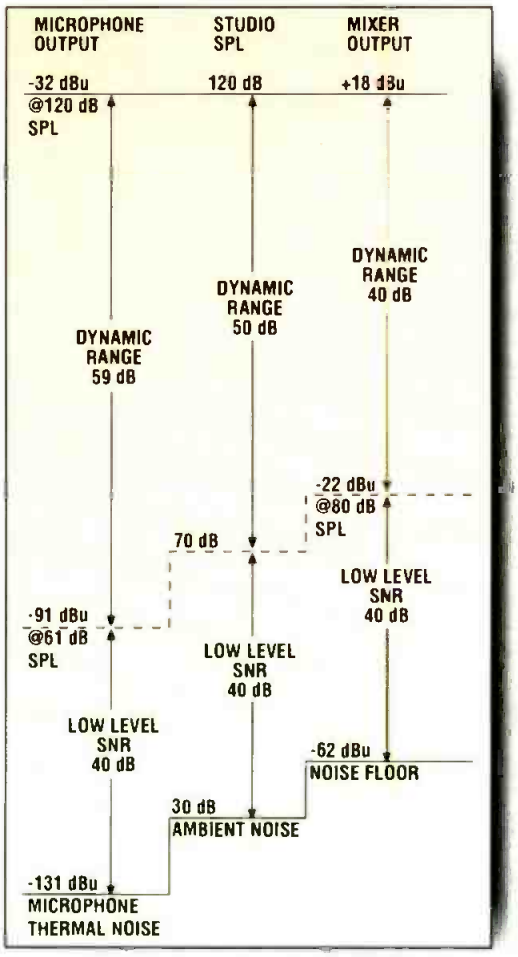


Figure 1. The factors shown above contribute to the dynamic range within a studio environment.

peaks exceeding 10dB above SOL. The situation is worsened by the use of high-frequency pre-emphasis in the recording amplifier to compensate for tape losses. This can lead to tape overload in the presence of high-level, high-frequency spectral components in the audio signal. The amount of high-frequency pre-emphasis depends on the class of the equipment and the tape speed. The SNR with reference to the MOL is typically between 40dB and 60dB, depending on the class of the equipment. This results in a reduction of the dynamic range to 20dB.

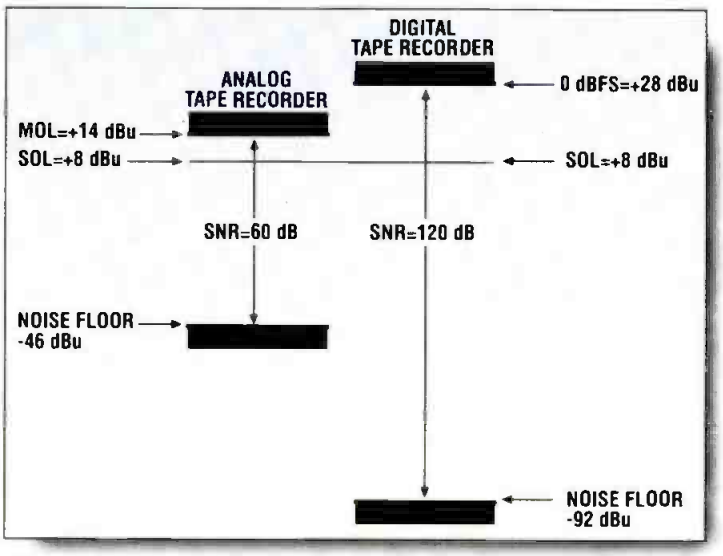


Figure 2. Comparison of the various levels associated with analog and digital tape recorders.

There are few and conflicting choices to correct the dynamic range problem of the analog audio tape recorder, including:

- Using a Dolby-type dynamic noise reducer.
- Accepting a reduced SNR at low signal levels.
- Accepting a certain amount of clipping of short high-level audio-signal peaks.
- Using premium grade audio tape.

The ultimate improvement is obtained by replacing the analog audio tape recorder with a digital audio tape recorder.

Digital ATRs: The maximum audio signal level accepted by digital audio tape recorders before clipping is the largest digital code the A/D converter can offer. This level is called 0dBFS (decibels full scale), and all digital levels are referenced to it and assume negative values. The noise floor, a consequence of quantizing errors, is the quantizing noise that is on the order of -120dBFS for a 20-bit A/D converter. The resulting signal to quantizing noise ratio is 120dB. Quantizing noise occurs only in the presence of an analog audio signal and can best be described as "noise behind the signal." At low analog input signal levels, the quantizing errors result in signal distortions, which explains the choice of 20 bits for high-quality signal processing. In the absence of an analog audio signal at the input of the A/D converter, no audible noise exists.

The maximum signal level (MSL) is the analog RMS voltage corresponding to 0dBFS for a particular system or device.

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61	22.40	40.19
34	1.00	13.19

Table 1. Open load SNR at dynamic microphone output based on SPL.

The SOL is the analog steady-state RMS voltage that deflects the VU or PPM meter to reference level. SOL is expressed in dBm or dBu. Manufacturers have chosen -20dBFS as the SOL (equal to +8dBu or 0VU) , which results in 20dB of headroom. This ensures that digital audio tape recorders will accommodate peaks extending 20dB above the average. The resulting dynamic range, assuming a low-level SNR of 40dB, is on the order of 80dB.

In analog audio environments that use VU meters for audio signal level monitoring, digital audio tape recorders may be fed with occasional peaks exceeding +10VU. The 20dB headroom of the digital audio tape recorder ensures that under practical circumstances there will be no signal clipping. The overall dynamic range is then determined by the audio console.

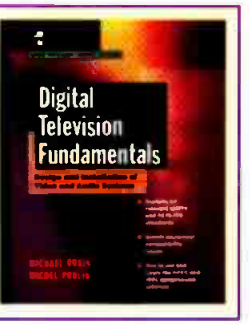
In analog audio environments that use a PPM for audio signal level monitoring, audio signal level peaks will normally not exceed 3dB above SOL. Some organizations using PPMs tend to restrict the digital audio tape recorder headroom to less than the 20dB reserved by the manufacturer in an effort to further increase the SNR. Encountered headroom values may vary between 12dB and 18dB. Under these circumstances, there is a high probability that occasional audio peaks will reach 0dBFS. With reduced dynamic range audio signals, the average audio signal energy will hover around 0dBFS. This could create some problems when digital audio tape recorders are used to feed analog audio equipment. The 0dBFS peaks result in +28dBu analog signal audio peaks that will overload conventional analog audio equipment.

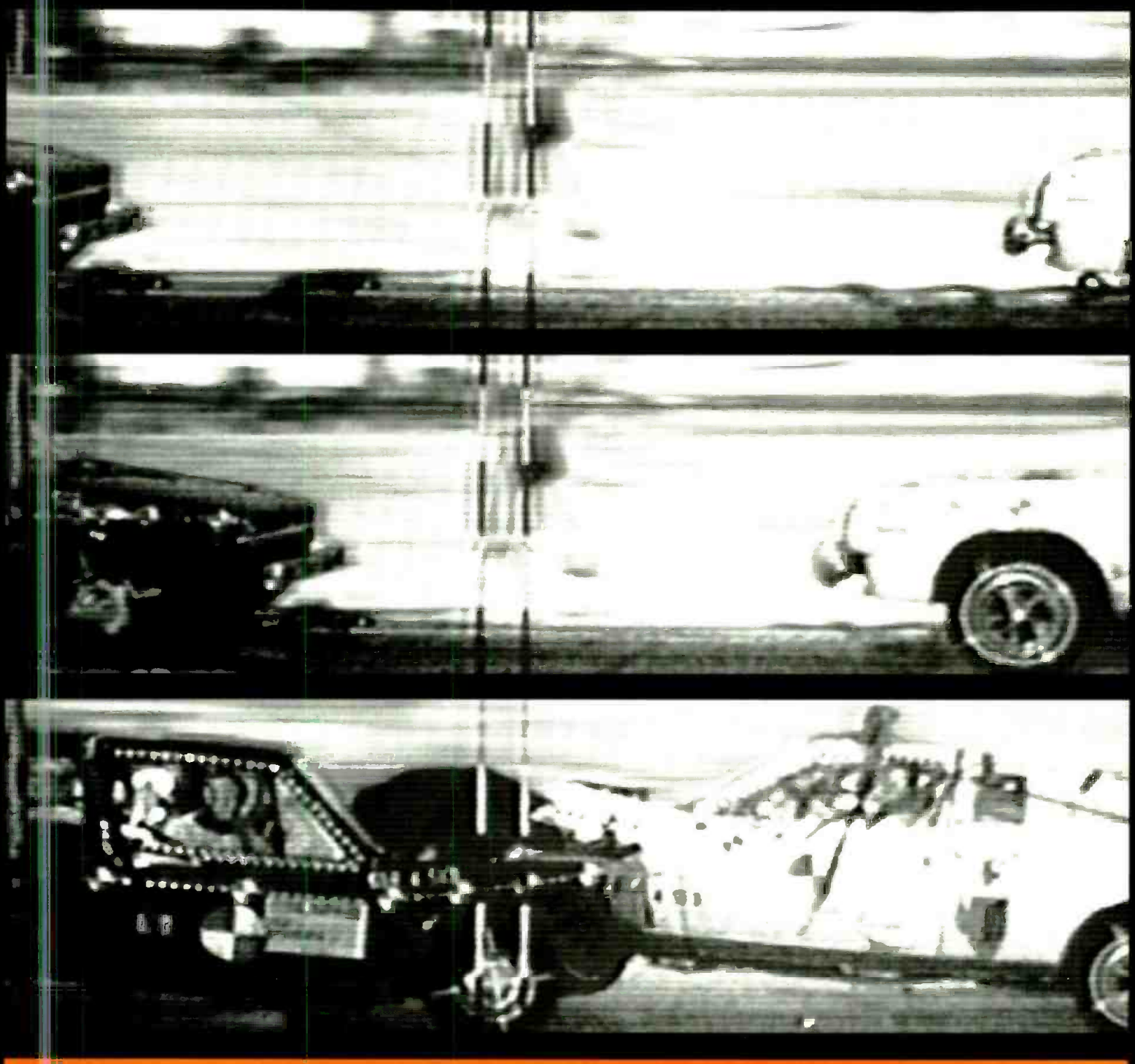
Using digital audio tape recorders in an analog audio environment offers a quasi-transparent recording medium. A few ground rules will ensure a smooth integration into an analog environment:

- The 120dB SNR typical of 20-bit digital audio equipment results in considerable dynamic range. However, reducing the 20dB overhead results in only a marginal benefit and should be avoided.
- Changing from VU meters to PPMs is recommended.
- If the superior dynamic range of the digital audio tape recorder exceeds the capabilities of the analog signal distribution medium, use soft compressors at the interconnect point. ■

Michael Robin, former engineer with the Canadian Broadcasting Corporation engineering headquarters, is an independent broadcast consultant located in Montreal, Canada. He is the co-author of Digital Television Fundamentals *published by McGraw-Hill (see below for details on this book).*

Michael Robin's book may be ordered directly from the publisher by calling 800-262-4729. It is also available from several booksellers.





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avoiding downloading of files containing viruses, securing e-mail from prying eyes, preventing the use of your e-mail server for illicit purposes and even eliminating the threat of someone gaining access to your desktop or file server. Interestingly enough, the Internet is also an excellent source of information on security concerns.

At a minimum, install a firewall system between your network and your Internet provider. Believe it or not, without firewall protection, if you have a direct connection to the Internet and are using Windows 95 that is "file-sharing" enabled, people on the Internet can browse your hard disk at will.

Firewall systems are specialized computers that act as gatekeepers. They keep unauthorized people who are on the Internet from accessing information on your local network. They allow authorized communications with the Internet, and some models look for suspicious activity that could indicate that someone is trying to "crack" the firewall.

If you have an internal e-mail server and are connected to the Internet, be on the look-out for potential problems. One recent technique has been to "bounce" spam (unsolicited e-mail) off poorly protected e-mail servers. In this rather creative activity, someone sends a large number of e-mail messages to your server and redirects them to their intended recipients. Through some clever manipulation of the e-mail headers, it appears that the spam came from your site. Then, not only are you deluged by the e-mail from the spammer, but when the e-mail is particularly obnoxious, you can be swamped by numerous e-mails from people expressing their displeasure at receiving the spam. To avoid this sort of security breach, install anti-spam software on your e-mail server. Several programs are available, and they fix a number of e-mail security loopholes. Contact your e-mail vendor for suggestions. ■

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

Password guidelines

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Ask Dr. Digital

Component level repair in a black box world

BY STEVE EPSTEIN

Believe it or not, I am still getting requests for the 7788 modification for those old Tek 529 scopes (see "Ask Dr. Digital," Feb. 1998, p. 58). And, while researching a reader question, I found the following letter in the May 1982 issue of *Broadcast Engineering*:

With reference to the article "Transistors Solve Tube Problems for the 529" on page 74 of the December 1978 issue of *Broadcast Engineering*, I have determined that changing the value of the newly added zener base bias diode from 27V to 12V (1N4742) allows Q_{164} and Q_{264} to operate nearer the V_{ce} and dissipation of the original tube design. This prevents thermal runaway and latch-up conditions from occurring to the output stages, while preserving the original dynamic range and linearity of the display.

Also with reference to RM 529 scopes from serial number 10670 and up, the modification in the original article will not work properly without additional work, because the operating points of the entire vertical amplifier have been changed from those indicated on the schematics. Symptoms include trace compression and lack of dynamic range at the top and bottom of the display.

For those who wish to take a chance, the original modification can be made to work by carefully altering the value of R_{123} to reprogram the current source Q_{124}, so that the feedback pairs Q_{144}-Q_{154} and Q_{244}-Q_{254} are operating in the center of their dynamic range, with the vertical position knob in the center of its range and the DC balance set for equal DC voltages at Q_{154} and Q_{254} collectors. The existing R_{123} is usually paralleled with a selected resistor to do this.

Edgar Lee Howard
Supervisor, Special Projects
WOSU-TV, Columbus, OH

Well there you have it, if you made the modifications to those 529s, and they didn't work quite the way you expected, maybe Edgar has the answer.

Moving to something a little more modern, I have received quite a few requests for that switcher software (see "Ask Dr. Digital," March 1998, p. 58). One of the most recent letters follows:

Received your software. We've tried to use it with our GVG110 and GVG200 switchers, but it doesn't work. I suppose the protocols are different. At any rate, I'm very grateful.

Kepa Murua

Yes, probably a difference in protocols. Nevertheless, I am checking with Tektronix (Grass Valley) to obtain the instruction set for the 110/200 series switchers. If I can get it, I will modify the program to work with the 100/200 series as well. If anyone is interested in a version for the 100/200s, let me know.

This is customer service

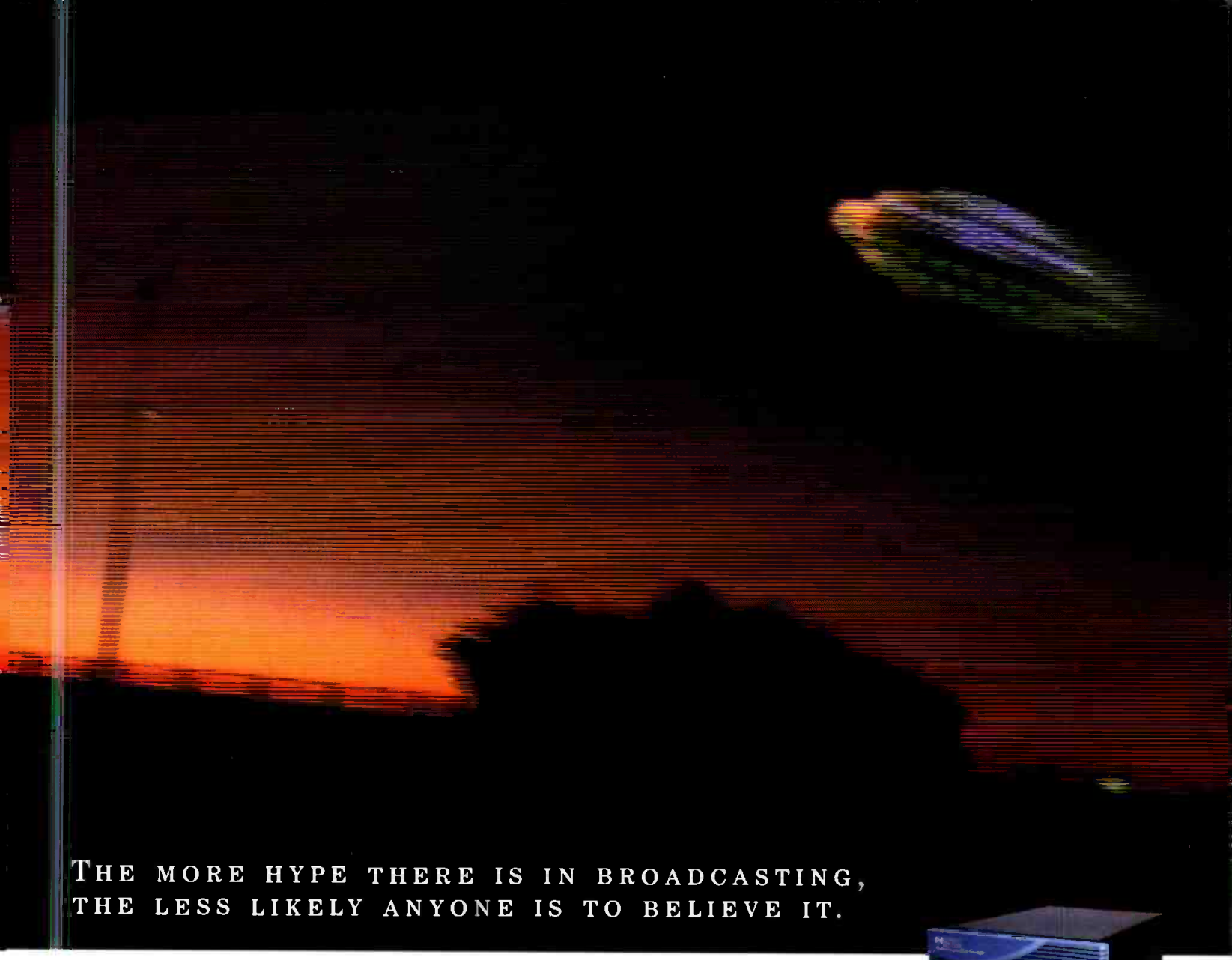
Now, on to one of my favorite subjects — customer service. Recently, I tried to connect with my ISP from my home computer. The warning message on the screen said "no dialtone." The night before, we had an intense lightning storm, and after a few checks, it became apparent that the telephone/modem ports in my surge protector had been blown. This particular surge protector was made by Kensington and is about four years old, but is still under warranty. When I called the company, the friendly woman who answered said a new unit was on the way and I received it in two days — no hassles, no problem. She even said that I didn't need to return the defective unit. Now that's customer service!

By the way, after the new one arrived, I opened up the old one and found a pair of blown inline fuses mounted on the telco board. Once they were replaced, the old unit worked fine.

Component level repair

While we're on the subject, I'd like to address the value of component level repair, which seems to be a dying art. It's no wonder; with most of today's equipment, it is cheaper to replace the equipment rather than to repair it. Many times, I have spent an hour repairing something that I could have replaced for a few dollars. Although at the time, it may not have been cost-effective, practicing my repair skills has paid off many times. For example, last week I was upgrading an old 486, and while removing the CPU, I managed to pop a 22µf surface-mount capacitor off the motherboard. As it turned out, one of the mounting pads had separated from the motherboard, leaving only a small trace and feed-through hole about the size of an "i." It took about 15 minutes to get the motherboard out, heat up the soldering iron and execute the repair, but in the end, it worked. So far, every computer *technician* that I've talked to has had the same response — "replace the motherboard." They may be technical, but electronics is apparently beyond their area of expertise.

Whether it is modifying old scopes or repairing motherboards, component level repair can save you and your facility a tremendous amount of money — even today. Broadcast engineers are among the few still practicing this craft. If there is any way I can be of assistance, whether it's yesterday's analog equipment or today's digital, let me know. Send me an e-mail at drdigital@compuserve.com. ■



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Transmitter maintenance

BY DON MARKLEY

Far too many years ago, this author started work at a full-time AM radio station in a market that barely fell within the top 100. As the new kid on staff, the assigned hours were between midnight and 8 a.m., with Tuesday and Wednesday off; a truly great shift. On the other hand, it worked well for a student and included sole or shared participation in transmitter maintenance.

The transmitter was a 5kW Westinghouse, originally installed in 1948, but it looked as though it had just been delivered. Once each month, it was washed internally with soap and water. Periodically, the outside was paste waxed. It had about 1,000 meters that allowed for the monitoring of all the voltages. They were religiously maintained at their proper values and faithfully logged. All reasonable spare parts were carefully inventoried and stored. In those days, the high-voltage rectifiers were mercury-vapor types. New tubes had to be operated with only filament voltage for several hours to remove the mercury from the elements before high voltage could be applied. That was done in a spare socket, and the tubes were stored upright until needed.

A ledger was maintained in the operator's console. *Everything* that had been done to the transmitter since it was installed could be found in that ledger. Whenever a failure occurred, all symptoms were detailed along with the pertinent meter readings and the necessary repairs. When someone new was hired, the first requirement was to read the transmitter's instruction book. The second was to read the ledger carefully. The immediate result of this was that everyone at the transmitter was familiar not only with its theoretical workings but also with every problem that had ever occurred. The final result was that when the transmitter did have a problem, repairs were accomplished very quickly. Unscheduled downtime for the transmitter averaged less than two hours per year. That was for an all-tube transmitter. Let's face it, that kind of reliability is highly acceptable even for modern solid-state equipment.

It should be pointed out that the antenna tuning units were also kept clean and in good mechanical condition. The radials were all resoldered every four or five years. Nothing was allowed to grow within 20 feet of the towers. Everything was mowed, painted regularly and cleaned, resulting in a reliable and stable station.

That was then, this is now

Now, the situation has obviously changed. For one thing, there is no row of 8008s lined up at the transmitter waiting to be installed. Except for a few stations in the largest markets, there is no full-time staff at the transmitter. Most radio stations are lucky if there is one full-time technician with less than three stations to maintain.

However, it is still possible to find a well-maintained station here and there. One example is WBOC-TV in Salisbury, MD. Although the station is not manned on a full-time basis, one technician is assigned as the transmitter supervisor. It is his responsibility to see that everything at the transmitter site is properly maintained and adjusted. The old RCA transmitter was operating as though it was new. Every pilot light in every push button worked. Even those weird little meter relays all worked perfectly. The newest klystron in the place had more than 80,000 hours on it, yet the transmitter performance was perfect. The transmitter wasn't the only piece of equipment that functioned in this manner. Although much of the test equipment was old, it all worked as if new. This was

FRAME GRAB

A look at the consumer side of DTV.

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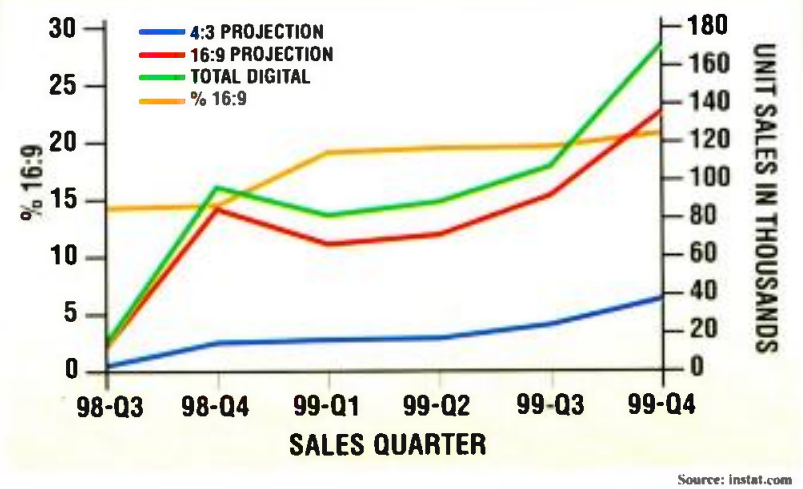

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- Hot-swappable boards and power supplies

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simply the result of continuing, careful maintenance. By the way, the place was spotless.

The lesson to be learned is simple; if the goal is a stable, reliable station operating right up to the capability of the equipment, provide plenty of tender, loving care. For every piece of gear, operating parameters have been determined by the equipment's designers for proper performance. When these parameters are allowed to vary from the desired values, system performance falls off. Every part in the transmitting system is there for a specific reason. Therefore, every part should be kept in place, adjusted properly and, most important, known to the technician responsible for the system.

Proper care and feeding

Critical to the operation of any electronic system, especially high-power equipment, is cleanliness. Accumulations of dust and dirt reduce component cooling, increasing the failure rate and decreasing the system performance. Ultimately, dirt accumulations will lead to premature system failure. If you don't keep the equipment clean and properly adjusted, it will go to that great porcelain convenience in the sky sooner than necessary. This could lead to the swift departure of those responsible for the servicing of such systems.

The solution is quite simple. The responsible technicians should learn about each piece of equipment in the system thoroughly. That means, at a minimum, carefully studying the instruction books. If training is available, hound the administration until those responsible are allowed to attend the factory school on major items. Then, get the place clean and operating properly. This usually requires significant hump busting when taking over a poorly maintained system. After that, the job really becomes simple. Maintain adequate air flows in all cooling systems and change filters religiously. Once everything is properly adjusted, do the little touch-ups that will keep it that way. Actually, less work is required to maintain the systems in this way than if you let them go to pot and then have to repair them.

You *absolutely must* convince the management and programming gurus to allow *regular* scheduled shutdowns of the equipment. Pick one night a month, midnight or so until five or six in the morning, to go through the system. In the interests of safety, have someone there to help. During that period, it is possible to do the necessary cleaning and adjustments to put the system right again.

You are faced with two simple choices. Either plan for scheduled shutdown and maintenance *or* experience unplanned shutdowns, probably at the most inconvenient times. Of course the transmitter will still have an occasional failure that takes you off the air. But, if you maintain it properly, those failures will be at a minimum. The current mode of programmers seems to be to stay on the air at all times. That is a totally unreasonable approach to the technical side of the station. If no interruptions at all are desired, the station must have a standby transmitter and antenna to allow everything to be properly maintained. ■

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

Production Clips

Fundamentals of grounding

BY KEITH SWITZER

Proper grounding of any building or studio is essential not only to protect the people who work there, but to also protect the facility and equipment. Essentially, the goal of any grounding system is to provide a low-impedance path for fault currents until they reach the earth. Therefore, grounding systems must offer protection from both electrical system faults and lightning. They must be designed to handle the highest anticipated fault current and, most important, to ensure that surge protection equipment operates as designed.

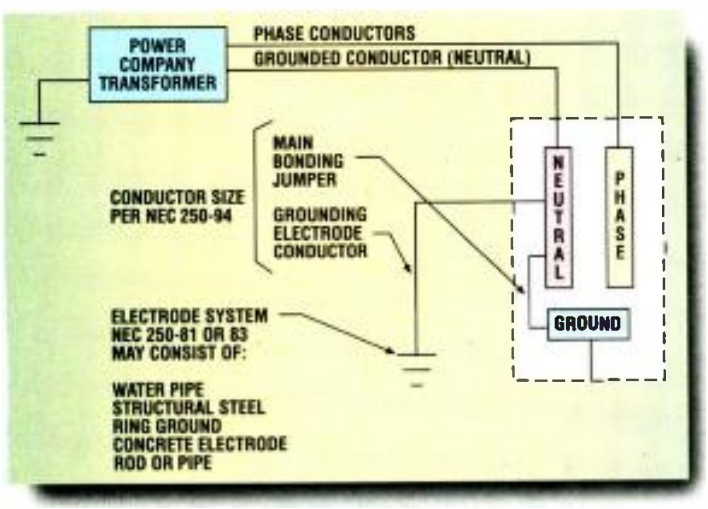

Figure 1. A building's ground is carried from the system's electrode ground through the breaker panel's neutral to the power outlet. This provides the fault safety needed to protect personnel.

Ground resistance

Many factors are important in determining the overall effectiveness of a grounding system. The resistance of the earth itself (earth resistivity) can significantly impact the overall impedance of the system. Several factors, such as moisture content, mineral content, soil types and soil contaminants, determine the overall resistivity of the earth. In general, the higher the soil moisture content, the lower the soil's resistivity. If your soil has high impedance, you can use any of several products to help reduce earth resistivity and maintain a low system impedance.

A megger is used to measure ground resistance. It uses a voltage source and an ohmmeter to directly measure the earth's resistance. Ground resistance should be measured whenever a ground system is first installed. The NEC, Section 250-84 requires that a single electrode consisting of a rod, pipe or plate with a resistance to ground of 25Ω or more be augmented by one additional electrode of the type listed in Section

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250-81 or 250-83. If you need more soil contact, extra electrodes can be used. These electrodes should always be installed so that they are at least six feet apart because spacing less than six feet decreases the rod efficiency. The goal when deciding how many and where to locate ground rods is to ensure that the maximum amount of fault current can be safely discharged into the earth.

Building exterior grounds

The metal columns around the perimeter of a building, when properly grounded, are excellent grounding electrodes and provide a good path into the earth for any fault currents that may develop on the system. A well-designed perimeter grounding system provides an equi-potential ground for all the buildings and equipment located inside.

The system's ground ring conductor size will depend upon the size of the electrical service but is seldom less than 1/0 AWG copper. In some cases, an electrical design may require ground rods in addition to the perimeter ground ring. Because the ground rods can reach deeper into the earth where the soil moisture content may be higher or the soil may not have frozen, ground rods help minimize the effects of dry or frozen soil on the overall resistance of the perimeter ground system. The ground ring and ground rods should be installed at least 24 inches from the foundation footer and 18 inches outside the roof drip line to allow for the greatest use of the water runoff to maintain good soil moisture content.

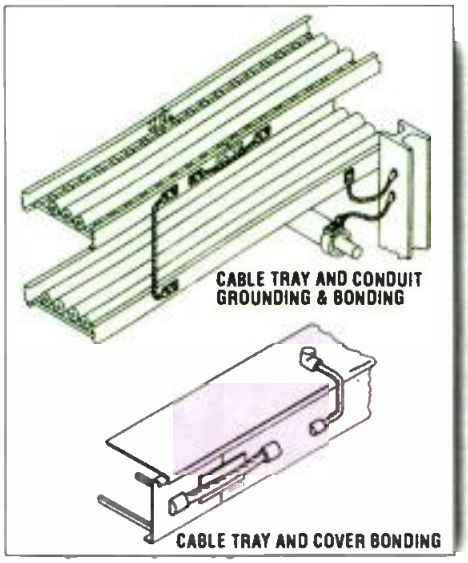


Figure 2. To properly ground metal cable trays, each section must be bonded to the other sections and the entire assembly connected to the building's ground system.

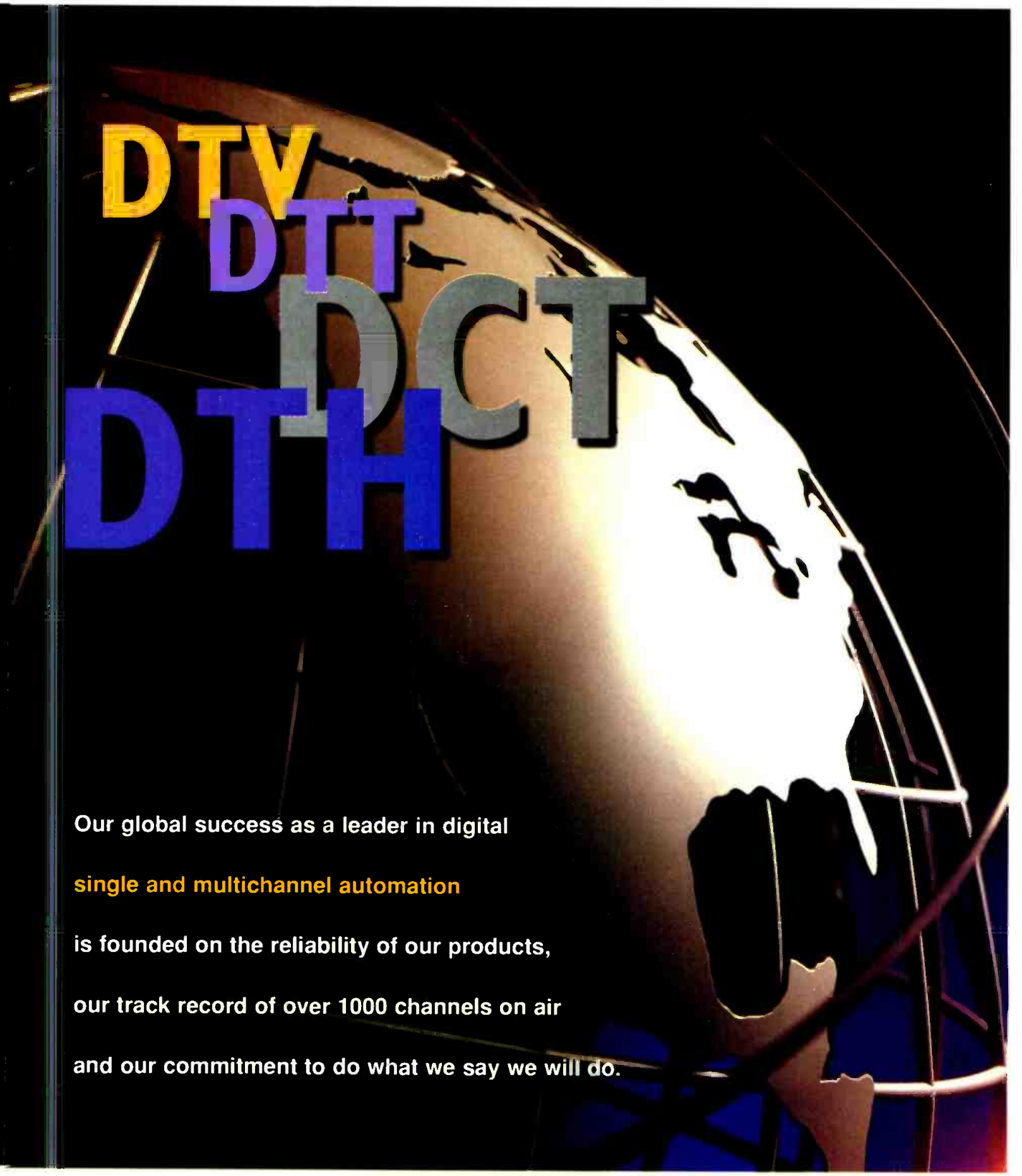
Sometimes you'll see *triad* (triangular) ground rod arrangements specified. Triad arrangements are not recommended unless the spacing between the ground rods is equal to or greater than the individual ground rod length. Three rods in a straight line spaced at least equal to the length of the individual ground rods are more efficient and result in a lower overall system resistance.

Interior grounding

Most electrical equipment must have a grounding conductor as dictated by the NEC. This is usually handled by the ground connection on the device's plug. Equipment that incorporates a double insulation system does not need a grounding conductor. This includes small tools such as most drills, saws and other appliances. However, in some cases, additional grounding is sometimes needed. If so, ground plates provide convenient accessible grounding points throughout the building

Section 250-42 of the NEC establishes six general conditions where certain noncurrent-carrying metal parts of fixed equipment must be grounded:

- Whenever such metal parts are located within eight feet vertically and five feet horizontally of ground or any grounded objects a person may touch.
- Whenever exposed metal parts are located in wet or damp locations.
- Whenever metal parts are in electrical contact with metal.
- When metal parts are in high-risk locations.
- When supplied by metal-clad, metal-sheathed metal raceways (see Figure 1).
- Whenever any other wiring method that has provisions for an equipment grounding conductor is used.
- Where fixed equipment operates at over 150V to ground.



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Since the early 1970s, the NEC has required that all receptacles installed on 15 and 20A circuits be of the grounding type. (See Figure 2.) Grounding type receptacles are the "three-pin" devices now common. Although adapters are often used to connect three-pin equipment to two-pin outlets or to "float" chassis, be careful. Not only is that probably not going to meet code, you may be creating a safety issue.

Grounding of sensitive devices follows the same principle as other equipment. However, digital equipment and medical devices often demand special considerations. For more information on grounding broadcast and production equipment (see "AC Power Quality," Feb. 1998, p. 86).

Cable trays

One area that engineers sometimes forget to ground properly is the equipment tray. To meet both national and local electrical codes, equipment trays must be installed correctly, which includes bonding and grounding according to strict guidelines.

An often-forgotten step in the installation process is that of grounding each section of the metal tray. The mechanical splice plates are not an adequate path for fault current. And, in the case of location within AM tower sites, a long piece of cable tray can become a radiator and generate high levels of RF noise.

A continuous ground wire may be run either inside or outside the tray. In both cases, the grounding conductor must be bonded to each section of the cable tray. Bonding jumpers, either the welded type on steel trays or lug types, should be used across each spliced joint.

When cable tray covers are used, they should also be bonded to the tray using a flexible conductor. Trays are usually bonded to the building steel, usually at every other column and to all conduits containing conductors common with the cable tray system. As shown in Figure 2, bonding jumpers — either the welded type on steel trays or the lug type — should be placed across each joint. ■

Keith Switzer is senior applications engineer at ERICO, in Solon, OH.

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Why does my signal need to be spotless in the new digital era?

Digital TV could impress your viewers with enhanced picture quality. But going digital calls for new standards of signal conditioning. Any noise or decoding artifacts such as cross-luminance and cross-chrominance that remain in your video signal will be encoded and transmitted along with the picture. As well as using up expensive bandwidth, these will be magnified if the picture is upconverted to HD. The solution is precision decoding and signal conditioning.

What am I missing with my current decoders?

Your racks may be full of decoders, but for the high-end decoding that is essential in the transition to digital you need a quantum leap forward in quality. The best approach is to use intelligent decoders that analyze the picture on a pixel-by-pixel basis and change the decoding parameters as appropriate. You also need to be sure that your decoder is using the best possible algorithms to guide its processing decisions.

Will my archives be able to match these new digital quality standards?

In the digital era, much of the program content will be archive material. Because this will often be mixed with digitally originated sources, it's vital that you use high quality signal processing when you retrieve it. Without precision decoding and really comprehensive signal conditioning, differences in quality will be clearly visible to the eye of the viewer.

VILCOX

GUIDE TO DIGITAL

What sort of filter do I need to remove different types of noise?

There is no single filter that can handle all types of noise.

Transmission systems such as satellites can cause random broadband noise and impulsive noise like "sparkles", depending on atmospheric conditions. Analog recording onto videotape can produce noise and dropout. And then there are the scratches, dirt or grain found on film transfers. Good signal conditioning will offer combinations of recursive, spatial, median and linear filters, designed and sequenced to deal appropriately with these problems in any particular environment.

Can cleaner signals help me to save money?

Yes. Dirty, noisy signals mean inefficient compressors. That's because compression encoders cannot distinguish between noise and the real image. Worse than that, noise, being random, occupies even more of the compression bandwidth than predictable picture differences. If you clean up your signals thoroughly, you can either broadcast more channels at the same bitrate or provide your viewers with much better quality pictures.

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SPECIAL REPORT

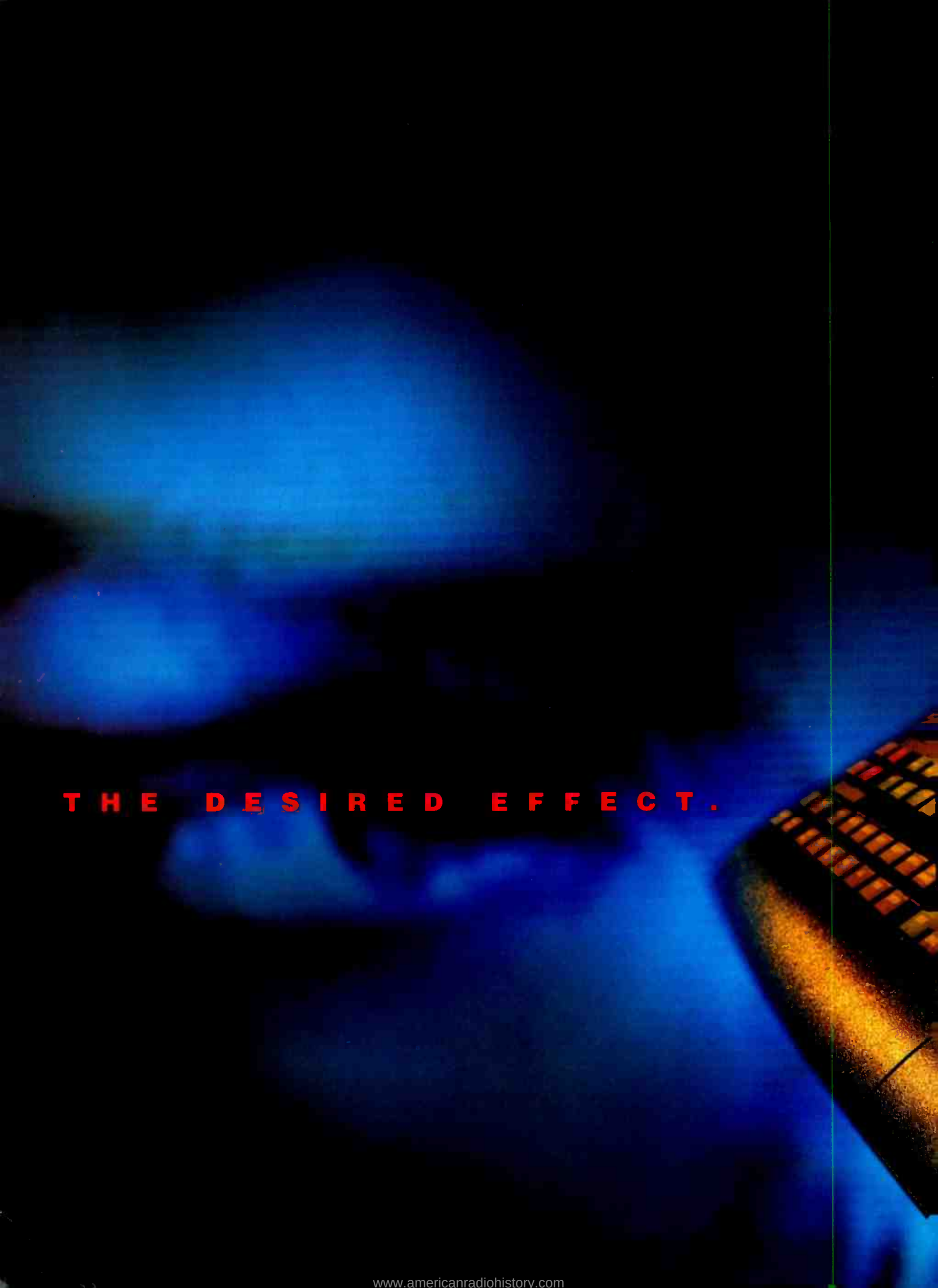
DTV Express: On the road to television's future

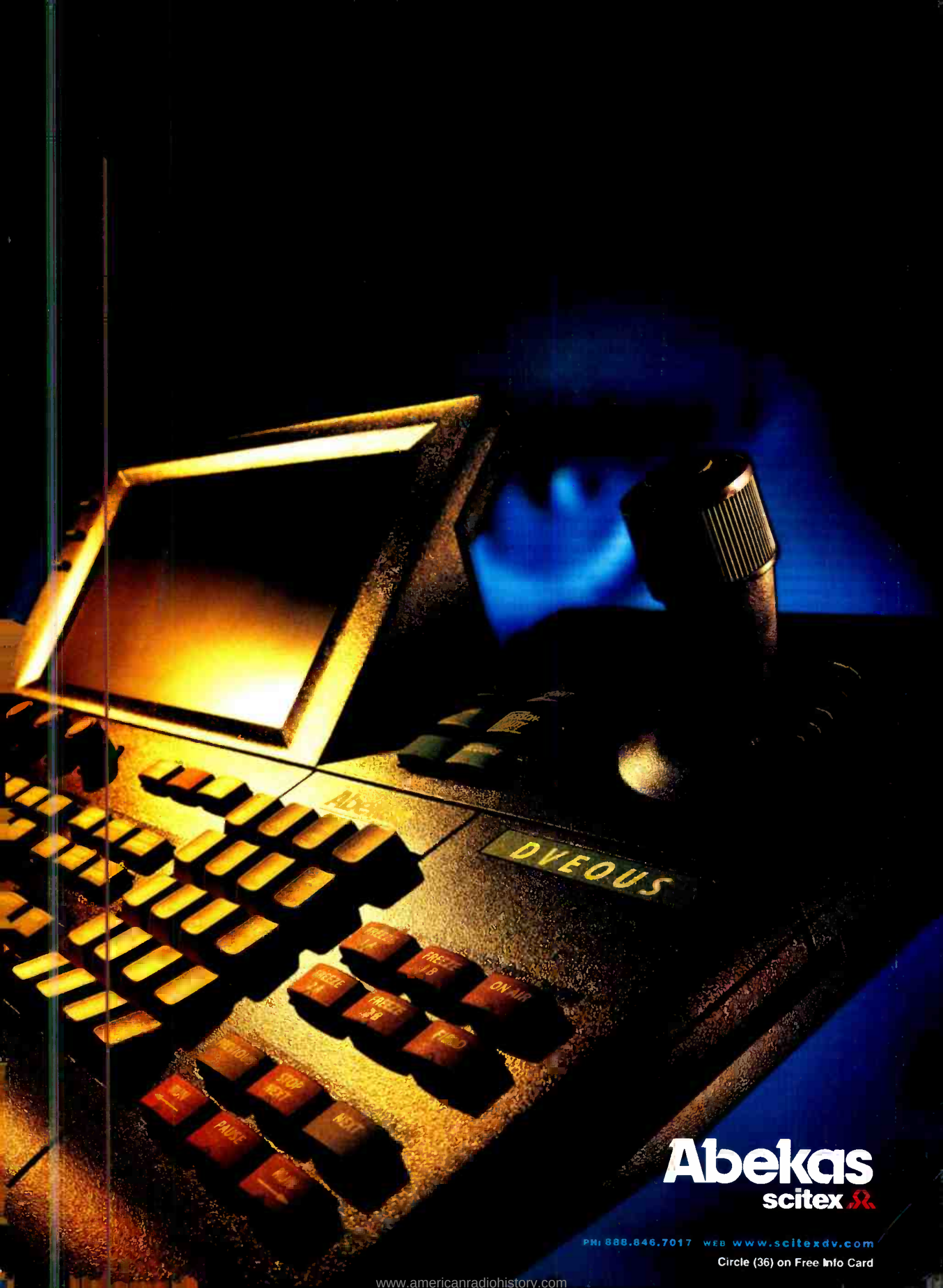
An ambitious educational effort takes to the streets.

By Jerry Whitaker

The challenge of moving from the familiar technology of NTSC to the largely unknown technology of DTV is that many of the important issues are still being sorted out, not the least of which is whether the possible implementations of DTV will work for any given station. The need for accurate information on digital television is at its peak now, as stations begin seriously planning for DTV transmission. The DTV Express, one of the most significant educational efforts in memory, is targeting this ongoing need.

Photo: After construction was completed, the DTV Express truck took to the road and made a stop near the U.S. Capitol building in Washington, DC. (Photos courtesy DTV Express.)





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DTV Express:
On the road to television's future

The DTV Express, a joint effort between the Harris Corporation and the Public Broadcasting Service (PBS), is a nationwide educational initiative aimed at informing broadcasters about the next generation of television technology — digital television. The 18-month road show includes a 66-foot tractor-trailer featuring equipment and programming demonstrations, a three-day technical and one-day management curriculum, and press briefings at approximately 40 sites throughout the United States.

Equipment installation required an army of engineers and months of work. A significant amount of time was spent working out interface and integration issues between different systems.

The DTV Express has two primary components:

- The demonstration vehicle provides working demonstrations of DTV technology, equipment and systems. Demonstrations of end-user scenarios in a so-called living room of tomorrow are also available. Through a variety of demonstrations, the many services afforded by DTV technology (HDTV, surround sound, multicasting and datacasting) are presented.
- A training curriculum provides practical, up-to-date information about the technical, managerial, economic, legal and regulatory aspects of DTV implementation.

The goal of the DTV Express is to enable attendees to understand the full potential of DTV and avoid the potential implementation pitfalls. Naturally, a key component of this process is evaluating DTV transition options for various types of stations.

Speaking from personal experience, this observer can attest to the enormous effort that the organizers have put into the project and to the wealth of information now available to the TV engineering community.

Inside the truck

The DTV Express truck, which was integrated by Harris Broadcast Systems Group, is divided into two areas: the technical plant (station areas) and the consumer areas. The station side contains studio and transmission equipment that broadcasters need for their

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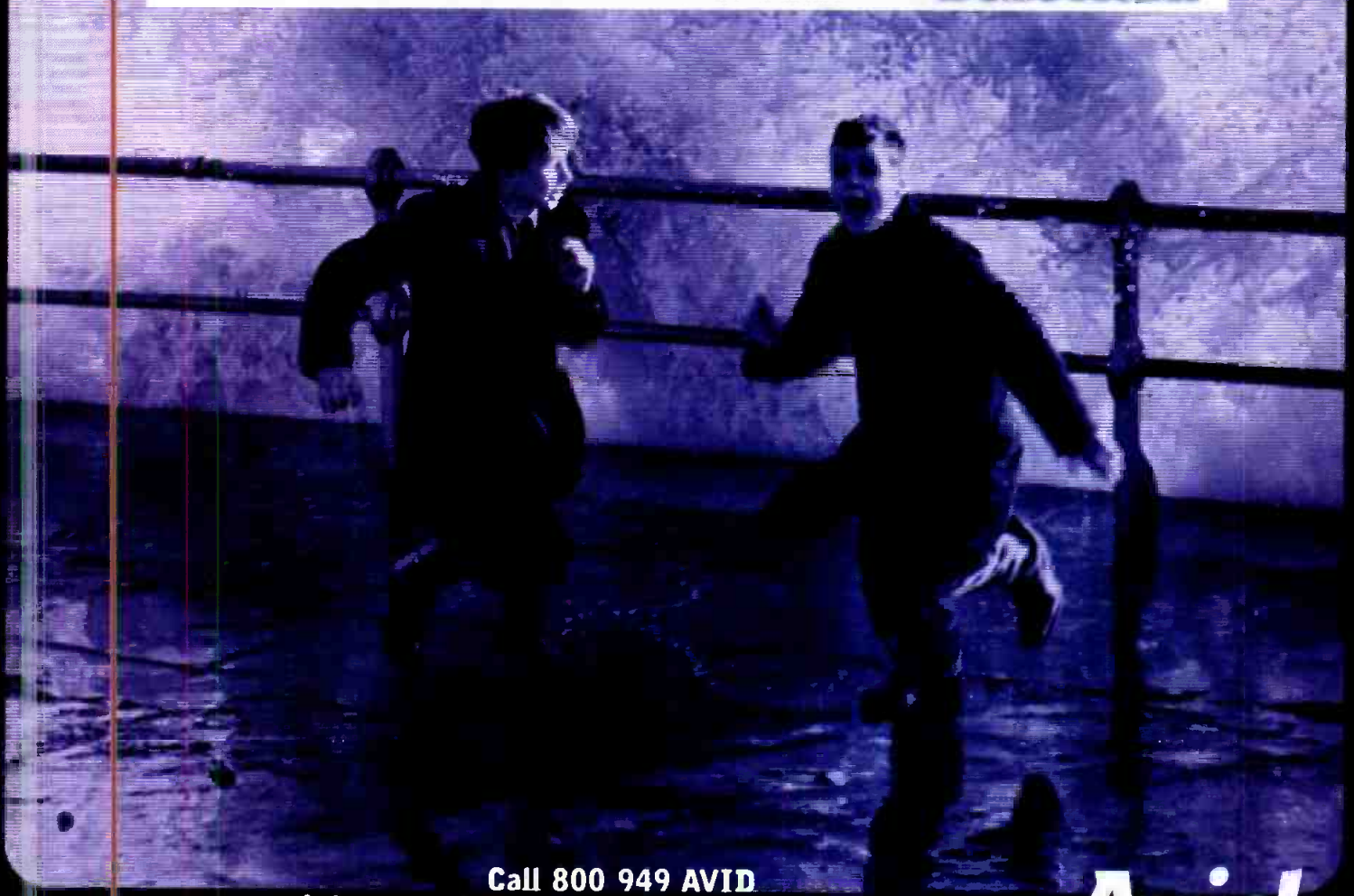

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DTV Express:
On the road to television's future

transition to digital. The consumer side comprises a living room or "home theater of tomorrow," if you will. The consumer side showcases the digital television appliances and services that consumers will likely have in their homes in the near-term future.

The station area of the truck includes typical equipment for a local network affiliate or PBS member station. Capabilities include reception of network feeds, local insertion and program origination, datacasting, ATSC encoding and multiplexing. It also includes the studio to transmitter link, 8VSB and NTSC transmitter exciters, off-air monitoring and test-and-measurement equipment.

Technical systems are configured to handle high-definition in the 1080i format and standard definition in 480i format. Progressive formats will be added with planned equipment upgrades during the tour.

The completed master-control area, showing the slide-out video and audio switchers.

Station-area capabilities

So what can you do in the truck? The following capabilities are provided to show engineers how HD can be handled at the station.

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compressed at 1.485Gb/s, SMPTE 292M standard):

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- HDTV camera.
- D-5 VTR recorder.
- Up and down format converters.
- HDTV monitoring, digital routing and video system equipment.

Standard definition (distribution is uncompressed at 270Mb/s, SMPTE 259M standard):

- 16:9 SDTV camera.
- Graphics system.
- DVCPRO VTR.
- SDTV four-channel video server;
- SDTV four-channel master-control switcher.
- SDTV monitoring, digital routing and video system equipment.

Audio (distribution is AES/EBU throughout, with stereo, Dolby Pro-logic and six-channel AC-3 capability):

- Digital audio mixer.

The home theater section of the truck includes a variety of display types and ancillary services.

- CD and digital audio storage.
- Monitoring and other audio system equipment.

Master clock, time code and automation systems:

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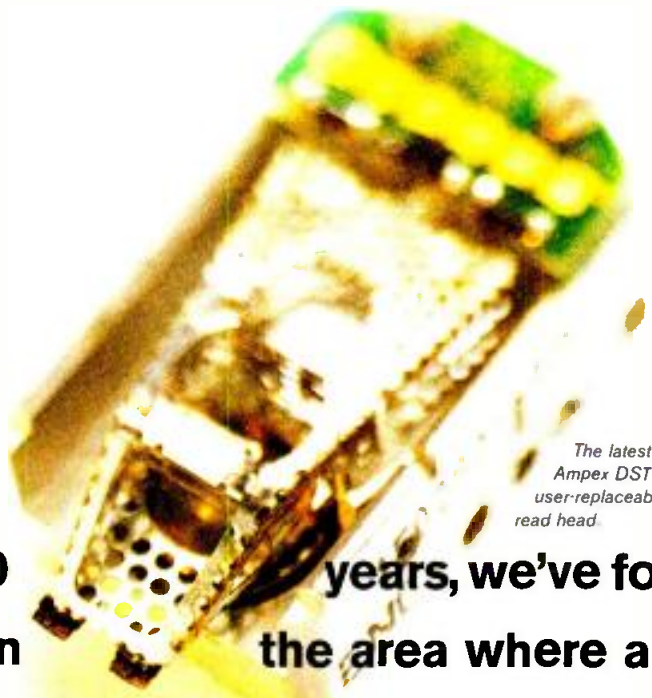

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ment.
- Studio to transmitter link (multiplexed ATSC and NTSC programs).

Transmission and RF:
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- NTSC exciter.
- RF "impairment generator."
- Equipment to demonstrate DTV/DTV

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The process of putting the DTV Express truck together was an industry-wide effort. Some of the companies involved include:

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- AmPro Corporation
- Barbizon Light
- Belden Wire & Cable Company
- BEST Power
- Chyron Corporation
- Clear-Com Intercom Systems
- COMPAQ
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- NUCOMM
- NVISION
- Panasonic
- Philips
- PRODELIN Corporation
- Samsung Electronics
- Sencore
- Snell & Wilcox
- Stanford Research Systems
- Sun Microsystems
- Sunfire Corporation
- Symetrix Inc.
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- HDTV and SDTV video projectors.
- Six-foot 16:9 screen, 34-inch direct-view DTV and 27-inch NTSC TV sets, 42-inch flat-screen plasma display.
- Six-channel surround-sound audio system.

Data broadcasting:

- Computer system with ATSC receiver/decoder plug-in cards.
- Computer printer.

All aboard

The DTV Express instructional effort is unique in broadcast history. This ambitious program has already played to good reviews by attendees in Los Angeles, San Francisco and other stops along the DTV Express route.

As with most areas of technology, digital television is easy to understand once you understand it. The DTV Express goes a long way toward providing answers to some of the industry's toughest questions. ■

Editor's note:
For more information on the DTV Express, contact the DTV Express web site at www.dtvexpress.org or call 1-888-733-3883.

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

DTV Express tour schedule

The remaining stops on the DTV Express tour for 1998 are:

- WNET, New York, Aug. 3–7
- New Jersey Network, Trenton, NJ, Aug. 10–14
- WHRO, Norfolk, VA, Aug. 24-28
- KET, Louisville, KY, Aug. 31–Sept. 4
- WETA, Washington, DC, Sept. 7–11
- Wisconsin PTV, Milwaukee, Sept. 21–25
- Ohio PTV, Columbus, OH, Sept. 28–Oct. 2
- Boston (site to be determined), Oct. 5–9
- WFYI, Indianapolis, IN, Oct. 19–23
- South Carolina PTV, Colombia, SC, Oct. 26–30
- WJCT, Jacksonville, FL, Nov. 2–6

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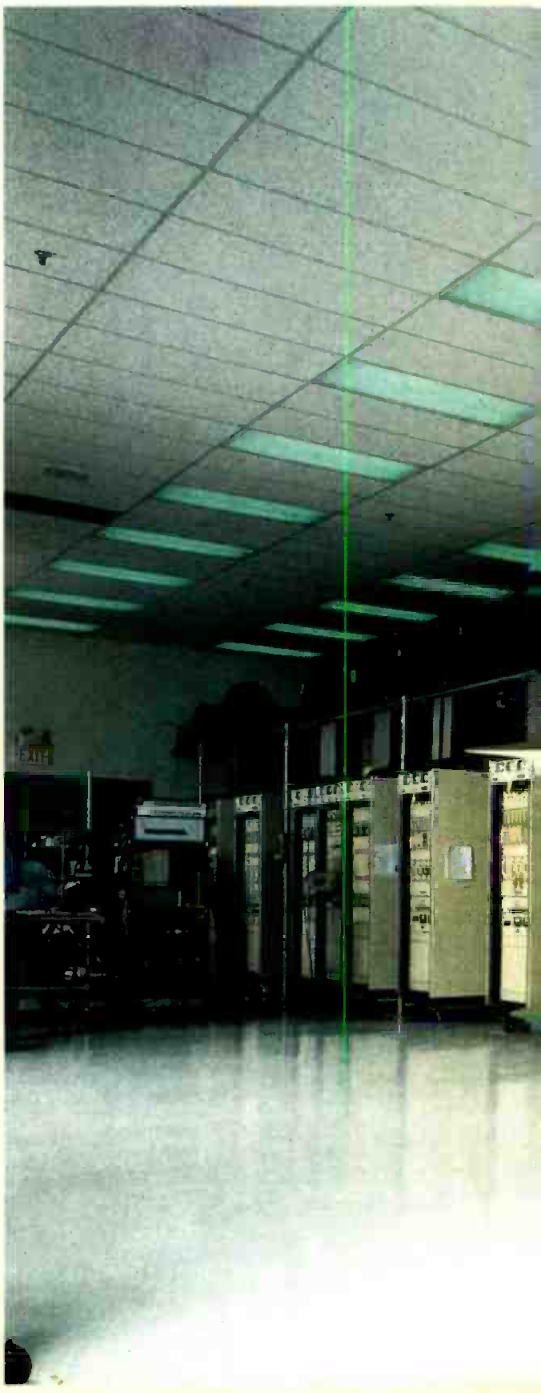
So you need to buy a transmitter?



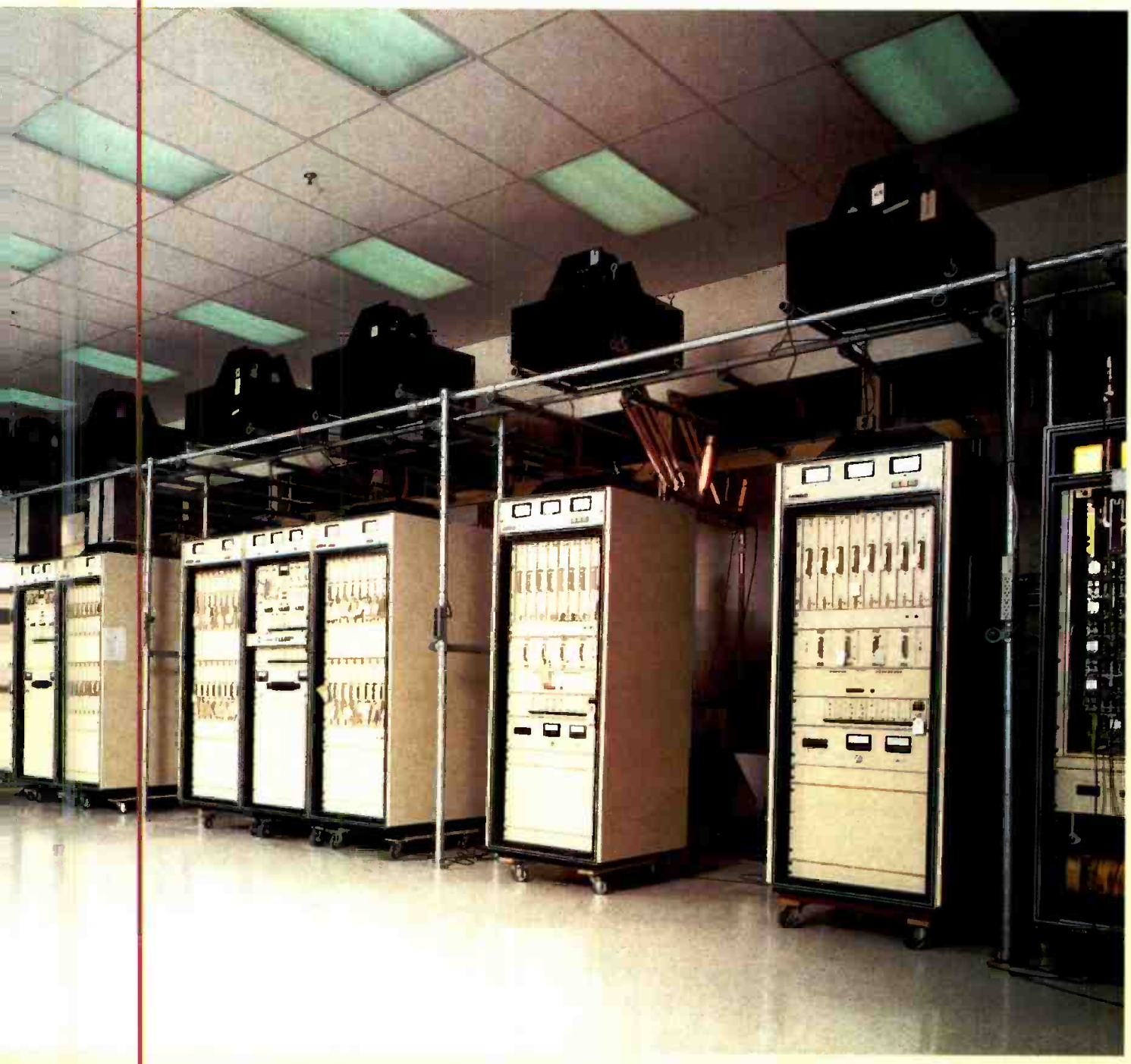
Choose carefully, there's a lot riding on this decision.

By Don Markley

Congratulations. You have finally reached the point in your professional career where you are part of "management." That is, you have attained the experience and expertise necessary for the owners and the station manager to look to you to select the new transmitter. For any size station, the transmitter is a significant investment that represents a large portion of the physical facility's value. Now, don't let it make you nervous. But remember, from this day forth, you will be known as the brilliant technical mind that boldly led the station into the next millennium or the idiot who bought that piece of junk in the back room.

In the early days of television, there was one brand of equipment that was considered by the majority of technicians to be the industry leader. With one possible exception, it was. Unfortunately, neither of those brands survived, which certainly gives one room for thought. Today, their names can be used without the fear of favoritism. RCA was thought by many to be the leader with regard to performance (it certainly was never considered to be the cheapest). If you didn't like RCA, you almost certainly were a GE fan. Of course, there was a ragtag element who sought out something else. In other words, there were the "big two" and "others." Many chief engineers simply placed all orders with their choice of the "big two" without further thought. Those who purchased RCA above anything else were said to suffer from "meatball worship," referring to the globe used as a symbol on that company's equipment.

There was a lot to be said for that approach to equipment purchases. By buying only RCA or GE, stations could be sure that they were getting the best equipment available. When the bills came, it was obvious they were also *paying* for the best. With rare exceptions, no one was ever fired for buying RCA and that same adage has been to applied to IBM. Well, today,



no one is going to buy RCA — they're out of the transmitter business. Otherwise, the adage would be as inappropriate as it is now for IBM.

The reason for all of this is simple. Regardless of a few closed-minded industry curmudgeons, these days, no one makes a bad transmitter. For one thing, the design folks move around from company to company — not as much as salesmen — but they still move around. Many of the skills developed by one company move along to other companies. As an example, years ago, a good design engineer left Harris, where he had been heavily involved in the design of its TV transmitters. He eased over to RCA where he blended his Midwest engineering skills with the East Coast crowd. The result was the RCA G-line of transmitters. He then went out on his own, along with a couple of guys who were experienced in business management and sales. The result was a company that provided a ton of exciters to upgrade old systems, produced excellent ITFS/MDS transmitters and now is moving on into high power.

Today's market

As a result of all this blending of information, not to be confused with inbreeding, there are no products out there that can be considered really bad. Therefore, they *all* need to be considered when making a purchase. As always, the first step is to look carefully at the transmitters available. The purpose of this article isn't to pick out a piece of hardware for you, but we will provide a brief overview of what is available. Then, we will look at the other areas of concern in the selection process.

Let's start with Harris. Its solid-state line of VHF transmitters is well-tested in the field, and they are a good example of mature products. Enough units have operated for enough hours to find and

Photo: Larcan transmitters in final testing at the factory.

eliminate the bugs. For VHF, tubes are essentially gone; however, for UHF, the question still lurks in the shadows. As that comparison has been discussed previously (see "Transmission and Distribution," May 1998, p. 48), let it be sufficient to say that the primary choice between solid-state and vacuum devices is a function of power levels and the associated costs.

Those who purchased RCA above anything else were said to suffer from "meatball worship."

Testing of solid-state ABE Elettronica TX1000/U which employs LD MOS semiconductors. With a digital modulator, units can work with DVB and ATSC signals.

Harris also has a mature UHF transmitter using the various configurations of IOT. The company has added an excellent solid-state transmitter that will operate at the higher power levels for DTV. Its only drawback at this time is cost — which is significant — as is everyone else's high-power solid-state approach. It is reasonable to say that the Harris solid-state UHF probably is a good indicator of what most systems will be like in the future; that is, lots of built-in aids for control and troubleshooting, decent efficiency and lots of redundancy. All decent solid-state transmitters will permit module replacement while on the air. Additionally, they should, as does the Harris system, have multiple independent power supplies to make the overall system as bulletproof as possible.

The Comark "IOX" transmitter installed at WXIN, Indianapolis.

For UHF, Comark, a Thomcast company, is the real fairy-tale story of achievement. The company is one of the industry leaders, and it has developed its product into a first-class system. Comark's transmitters are oriented toward the use of multiple IOT devices of all sizes and brands. It has spent a great deal of work preparing its transmitters to be capable of changing over from NTSC to DTV with a minimum of equipment replacements.

Larcan has enjoyed success in the VHF market and, since joining with TTC, is coming on strong in the UHF area. Its solid-state VHF line, like the Harris line, is mature. The company has gained experience with its units and offers a good, stable product. Larcan's new DTV units have sophisticated control systems that are built-in; this is becoming the industry norm. The company's UHF transmitters are a substantial redesign of the TTC systems. Again, the high-power units are designed around the various configurations of the IOT.

There are several other companies that, while often smaller, offer some good

Harris offers a variety of configurations in its Sigma line. Shown here is a three-tube version.

transmitters. A prime example is Advanced Broadcast Systems. Without a lot of hoopla, this company has been building a good, solid transmitter. Primarily high-power and based on IOTs, the Advanced Broadcast Systems' designs have not gone to the compact, shove-it-in-as-little-space-as-possible mode. The company has stayed with large cabinets that feature outstanding serviceability; in other words, you can get inside the units to work on them. The transmitters do have some unique characteristics in their correction circuitry, in that separate correction is applied to each individual IOT. Ask the company salesman to explain this feature further.

Acrodyne, an established company in the translator field added higher-power transmitters several years ago and now is into the full-power area with the Diacrode (for more information, see "Tubes for DTV," p. 94 in this issue.) Acrodyne has grown up admirably and was the first to introduce the Diacrode in the U.S. market. While the majority of Acrodyne's experience is in the 1kW through 5kW sizes, the company now has several 10kW and 30kW tube transmitters in the field. Acrodyne's Diacrode-based systems have some distinctive features, including what may be the easiest way to do first adjacent-channel diplexing of NTSC and DTV signals (see "Adjacent-channel DTV/NTSC transmitters using Diacrodes," Feb. 1998, p. 124).

The ITS transmitter line has now been integrated into the ADC portfolio. The ITS systems started as translators, LPTV transmitters, MMDS/ITFS equipment and replacement exciter/driver systems. Higher-power equipment has been added to its line. The company's reputation over the years has been one of high-quality products, and ITS definitely should be looked at as a real contender in the rush to DTV.

These days, no one makes a bad transmitter.

A well-known radio name, Continental, has recently introduced a new solid-state UHF transmitter. While currently only available in the lower-power levels, the plan is to increase to higher-power units. A big feature is that the exciter is fully software controlled. To switch from NTSC to DTV only involves issuing the appropriate instructions to the controller. This feature provides much flexibility especially where it may be used as an auxiliary transmitter.

Other domestic manufacturers that need to be considered include EMCEE and Astre. Finally, there are several international manufacturers that are definitely in the U.S. market for the long haul. Without going into all the names, the European manufacturers such as ABE Elettronica Spa, Elettronica Industriale, Itelco (which recently established offices in the United States) and PESA should definitely be looked at prior to making a decision. In a similar fashion, the Japanese manufacturers have clearly demonstrated excellent products for the U.S. market, such as the solid-state units (UHF and VHF) from NEC. No market evaluation is going to be complete without their consideration.

Making your decision

Once you have gathered information on all the available equipment, there are other considerations to include in the decision-making process. Be careful when dealing with new technology. Today's breakthrough may turn out to be a loser. There is a great deal to be said for staying with well-tested technology —as long as it doesn't cause one to ignore significant advances. In other words, be ready to accept new ideas, but do so with caution. If you are buying something on the cutting edge, insist on higher than the normal amount of warranty protection from the manufacturer. Be willing to move into new technology but only if the manufacturer provides you with that parachute, while they are gaining experience with the new product.

Next, an important area is customer support. This falls into at least three areas. First, when the transmitter is installed, it is highly recommended that you have the manufacturer perform a

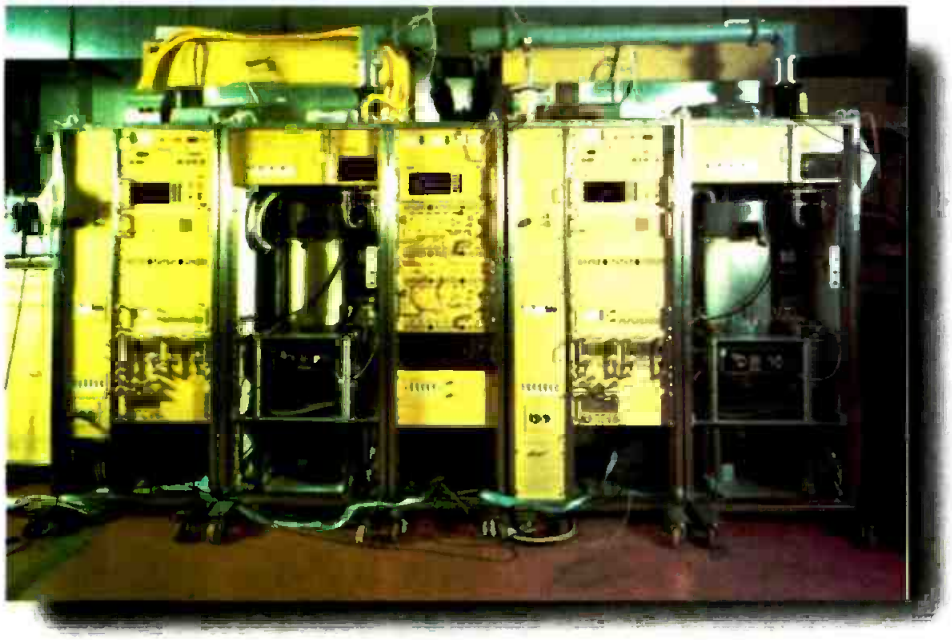
complete check of the installation before the voltage is turned on for the first time. If the manufacturer determines that the installation is acceptable and that everything is ready for operation, your warranty will not be wiped out if that new IOT is blown out of the cabinet.

Second, no technician should have to learn one of today's sophisticated transmitters, with their microprocessors and exotic amplifiers, without formal training. Be sure that the manufacturer offers classroom training on your proposed transmitter, complete with appropriate written materials.

Finally, you must be able to contact the manufacturer's support personnel when troubles occur. When you are trying to fix that mountaintop transmitter at three in the morning, an answering machine just doesn't cut it. You must *demand* that there be 24-hour-a-day technical assistance available. If in doubt as to the availability of such service, call in the middle of the night and see if someone answers. They might not like being tested in that way, but they won't mind if it turns into a transmitter sale.

Next, don't simply take a salesman's word concerning how well the equipment performs. If they are proud of their systems, they will gladly provide you with a user's list for the exact transmitter you are considering. Call several users and discuss the transmitter in detail. They should be able to tell you about the problems they have encountered, if any, and give you a good idea of the overall equipment performance.

The WKAR transmitter site in Lansing, MI, is home to this transmitter from Advanced Broadcast Systems.



An Itelco 604K 80kW IOT undergoing final acceptance tests at the factory.

After you have narrowed down your selections for your new transmitter, sit down with the corporate bean counter and work out a few details. First, determine the total power draw from the line for each of the prospective transmitters at your power level. Second, find out the life expectancy of the final amplifiers, either solid-state or vacuum and determine the cost of their replacement or repair. For vacuum devices, see if rebuilding is available. For solid-state modules, how much does it cost for factory repair if they are not field-repairable? Now, let your accountant determine how much each transmitter is going to cost you over the next 20 years. At the present time, interest rates are low. As a result, it may be less expensive to come up with a little more money

now to buy a more efficient transmitter with lower operating costs over its lifetime. Look at the tax advantages of a fully leased package as compared to an outright purchase. All of these financial concerns can be covered for you by a competent accountant. They involve a number of issues that are non-engineering and vary from station to station, depending on organizational structure, tax status and available capital. Don't be afraid to seek help in these areas. As an engineer, you aren't expected to walk on water — but the dampness should stop at knee level.

Remember, before you make the final decision, select your purchase based on performance, desired amplifier type, the reputation of the equipment in the field and the customer support that is attested to by other users. Although brand loyalty is nice, you have to buy the unit that will provide reliable service at a competitive cost over the years. Good shopping. ■

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

A transmitter's real costs

By Steve Epstein, technical editor

The cost of a transmitter over its lifetime is based on a variety of factors, among them, initial purchase price, efficiency, maintenance and residual value. Beyond those factors are financial considerations, such as the cost of money. As engineers, the primary considerations are found in the first sentence. The other items can be discussed with your corporate accountant. One final consideration is the cost of being off-the-air, which is something to discuss with the GM and corporate management. Let's look at the technical issues.

• ***Purchase/installation price:*** It is fairly easy to get a handle on the purchase price of a transmitter — some companies even list them on their web pages. However, don't forget those little extras that are part of getting that transmitter to your site and powered up; things like delivery, building modifications to get the unit through the door (or the roof), forklift or crane rental, changes in electrical service and even changes in the building's AC requirements. Transmitter manufacturers can be helpful in providing information relative to these costs; they have been through it many times at a variety of sites.

Other issues such as RF plumbing and transmitter cooling must also be considered. These will vary from installation to installation. They will also be different if the new transmitter is a replacement for an old unit or will operate as the primary with the old transmitter as a backup. In the latter case, some switch-over equipment needs to be considered. If this is a replacement, will the changeover result in any off-air time?

• ***Transmitter efficiency:*** The efficiency calculation provided by manufacturers may only reflect the efficiency of the final stage. What you need to determine is total electrical load relative to the new transmitter. This includes the cost of running the transmitter, pumps if it's liquid cooled, or blowers if it's air cooled, building air conditioners, if needed, and any other devices, such as monitoring systems, that are part of the new transmitter package. Getting a handle on these costs may be difficult, but like installation costs, the transmitter manufacturers can help.

• ***Maintenance costs:*** Good preventive maintenance will cost less than corrective maintenance (see "Transmission & Distribution," on p. 48 of this issue). Much of the reason for this is that problems can be caught and dealt with before major damage results. For example, a small leak in a coolant line resulting from a loose clamp can be corrected by tightening the clamp. If the leak increases and the coolant floods the power supply, the off-air time and repair costs will be significant. Preventive maintenance schedules should include inspection lists, and a timetable for replacement of significant items, such as blowers, PAs and other items affected by time and use. You will also want to determine schedules (both maintenance and cost) for support equipment, such as coolant pumps, heat exchanger motors, AC units, etc. All of these need to be included in maintenance costs as do labor costs for the time required. Finally, many manufacturers have a suggested spare-parts kit. Consider buying the kit along with the transmitter.

You have to decide how much those factors are worth, because you, or your successors, will be the one at the transmitter site at two in the morning — skinning knuckles and shedding blood — not the corporate accountant or the GM.

• ***Residual value:*** In light of the FCC rulings, transmitters that can't be modified for use with DTV may have little residual value. DTV-capable transmitters, however, should have some value when they are retired. Speak with the various brokers to determine some approximate values. If all else fails, assume your new transmitter will be worthless at the end of its tour of duty in your facility — that way if you get anything out of it, it's extra.

It has been my experience that the additional cost of a high-quality product is more than offset by reduced maintenance and downtime over the product's life. In the end, you have to decide how much those factors are worth, because you, or your successors, will be the one at the transmitter site at two in the morning — skinning knuckles and shedding blood —not the corporate accountant or the GM. ■

Transmission-line trade-offs for DTV

How to feed more power up the same line.

By Bob Leonard

One of the biggest concerns expressed by broadcast engineers at NAB '98 was the constraints imposed by their existing tower on their ability to add DTV capability. Often, it's not the DTV antenna that causes the problem with windloading, but the required second run of transmission line that pushes the tower over its load limit.

One approach, of course, is to build a new tower. Tower reinforcing and augmentation services are also available. If these aren't practical, there may be a third option for engineers willing to examine how the actual power handling capabilities of transmission lines are rated. How? First, by understanding the safety factors manufacturers use, and second, using this knowledge to push the envelope and install a smaller line.

This path isn't for everyone, as it may void your transmission line warranty, but all engineering choices involve tradeoffs between performance and costs. After looking at the facts, you might well conclude that intentionally running the line so hot that you have to replace it in five years at your own expense is preferable to not broadcasting at all. Besides, the simulcast period won't last forever, and then you'll only need one run of feedline on that tower.

Transmission-line choices

There are three basic transmission line options: waveguide, rigid coaxial line and flexible coax. The windload of waveguide depends on its shape (rectangular or circular) and size, and its size depends on your channel assignment. In all but a few cases, there is only one size of waveguide available for your DTV channel; if its windload is too high, you must use coaxial line. Manufacturer's safety factors are generally higher for rigid coax than for coaxial cable to allow for the possible effects of field matchers, tuning slugs, etc., so rigid coax and cable will be considered separately. You'll need to pay attention to *average power* handling capability if you will be using the line for broadcasting a single channel, but if you plan to multiplex several channels, you must also consider *peak-power* capability.

The power handling capabilities of coaxial lines are based on two factors: maximum peak power (related to the maximum voltage gradient that can safely be present) and maximum average power, which is determined by the allowable temperature rise of the inner conductor. Average power is the most critical, so let's consider it first.

Average power

The average power rating is determined by the amount of heat created due to line losses. Because the temperature rise on the inner conductor is greater than on the outer conductor, this rating is based on the maximum allowable inner conductor temperature. For conventional rigid coax sections, the inner conductors are connected by sliding bullet-type connection points. Field experience has shown that — barring improper installation or damage — the typical failure mode is burnout of a bullet from chronic excessive heating. Therefore, for rating purposes, manufacturers select an inner conductor temperature that they feel will result in an acceptable service life. For coaxial cable, which is continuous, heat and related temperature rise are primarily limited by the safe, long-term performance of the dielectric material used to support the inner conductor inside the outer conductor.

If we allow the inner conductor to reach a temperature of 100°C with an ambient temperature of 40°C, as assumed by several rigid-line manufacturers and typical for polyethylene dielectric coaxial cable, then the inner conductor temperature will rise 60°C above ambient. The average power rating can then be calculated from the following equation:

$$P_{avg} = \frac{16.380 * \sigma * D_{OD}}{M_\alpha * \alpha} \text{ watts}$$

Equation 1

where

P_{avg} = average power rating
D_{OD} = outer conductor outside diameter, in.
σ = heat transfer coefficient of outer conductor, watts/in^2, for 60°C rise of inner conductor temperature, per manufacturer's data
$M\alpha$ = correction factor for attenuation (relative to 20°C), equation 2
α = attenuation constant, dB/100' at 20°C, per manufacturer's data at channel of interest

One area not normally taken into account is the actual temperature of the inner conductor during operation; the higher inner conductor temperature at rated power results in *higher* attenuation values and consequently lower average power levels for the specified inner conductor temperature. The correction factor for attenuation ($M\alpha$) is:

$$M_\alpha = \sqrt{1 + \sigma_o (T_t - T_o)}$$

Equation 2

where

T_t = inner conductor temperature, °C
T_o = inner conductor temperature at standard rating, °C
σ_o = temperature coefficient of resistance at standard rating

For copper conductors and a standard temperature rating

Transmission-line trade-offs for DTV

for attenuation of 20°C, σ_o = 0.00393/°C. Therefore, if the average power rating is based on an inner conductor temperature of 100°C, during operation at rated power, the attenuation will increase by a factor of 1.146 over its value at 20°C. This calculation isn't typically used in system analysis, but should be considered for marginal DTV configurations.

When Equation 1 is solved using the manufacturer's published attenuation data, P_{avg} may come out slightly different from the published average power rating due to rounding of the attenuation constant. If the difference seen is too large to be accounted for by rounding errors, verify that the correct D_{OD} was used (two actual diameters are in common use for each nominal size — these are given in manufacturer's catalogs) and check to see if the manufacturer included the correction factor for attenuation.

Peak power

As mentioned, the peak power rating is the maximum amount of power that the manufacturer considers safe to apply to the transmission line. It is derived from the maximum voltage gradient between the inner and outer conductors.

The peak power rating, P_{pk}, can be calculated:

$$P_{pk} = \frac{\left(\frac{E_p * 0.707 * 0.7}{SF}\right)^2}{Z_o} \text{ watts}$$

Equation 3

where

E_p is the DC test voltage set by the manufacturer, set at approximately 35% of the theoretical value derived from the field-strength equation.

For most installations, the peak power rating will not be the limiting factor as it is typically much higher than a single transmitter system can generate. A primary concern will be for multiple channel installations where two or more signals are combined in the same transmission line. If the peak voltages from multiple signals of equal power add together in phase, the equivalent peak power rises as the square of the number of carriers. In this case, review voltage levels and peak power rating before specifying the transmission line.

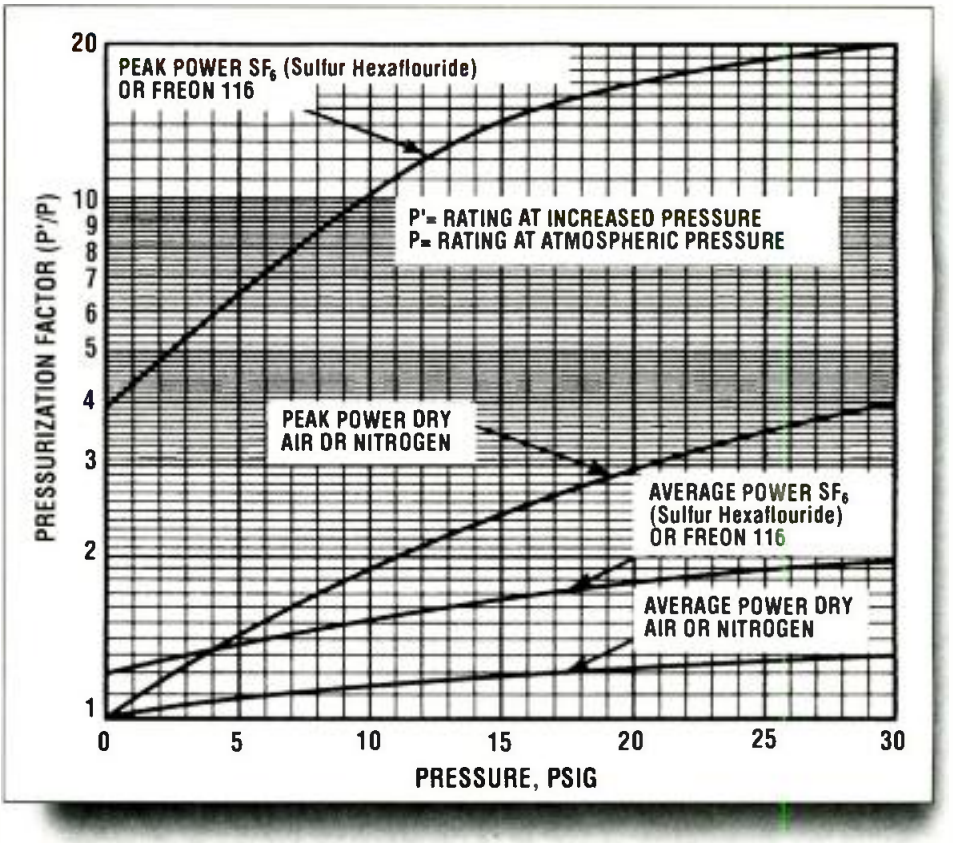


Figure 1. Pressurization factors, 50Ω line. It's easy to pump more through your line, just use more pressure, but, be careful; the loss of pressure or the use of SF_6 gas or Freon 116 carry their own operational cost penalties.

Manufacturers' ratings

Some manufacturers (Andrew Corporation and MYAT Inc., to name two) published new average and peak-power ratings for their transmission lines in 1998, so be sure you have the latest data. One thing to watch out for is the standard rating conditions used by each manufacturer, which affect average power rating. Everyone assumes a VSWR of 1.0, an ambient temperature of 40°C

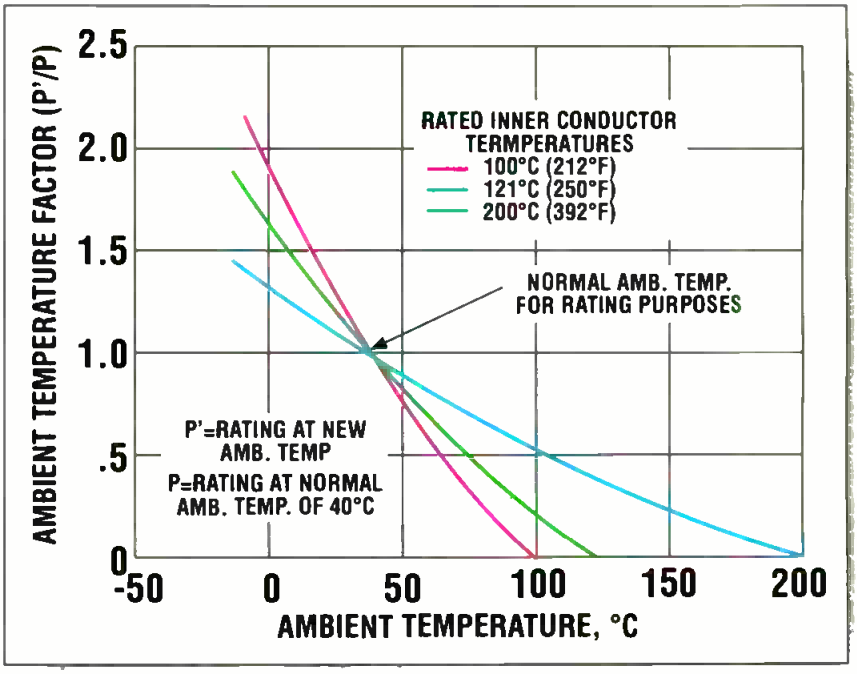
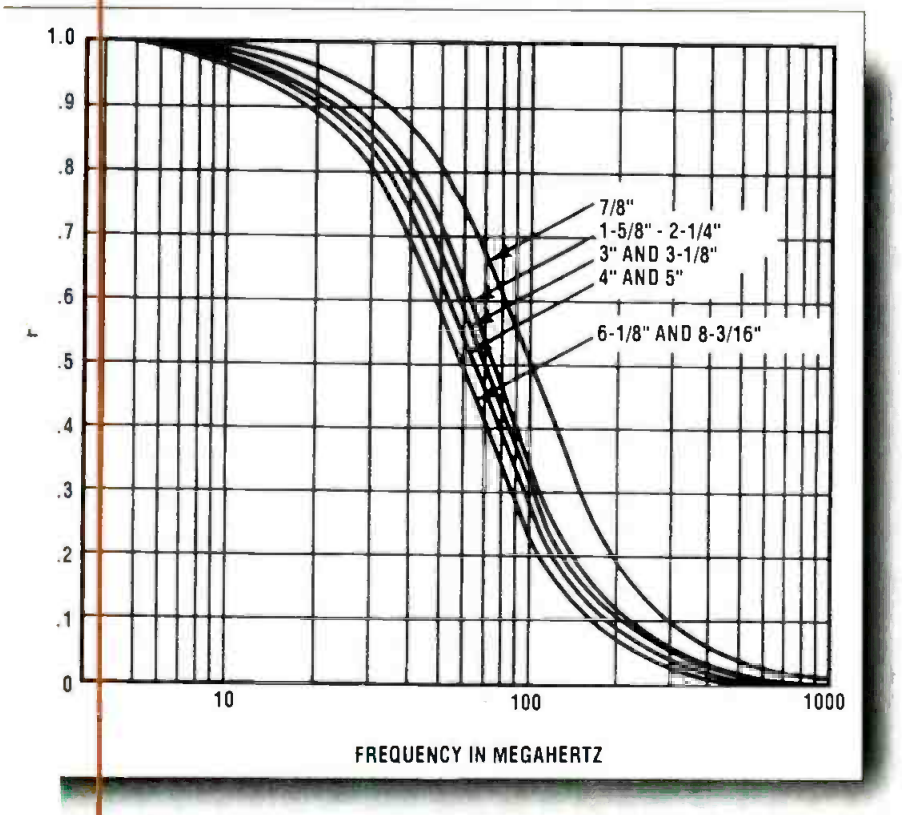


Figure 2. Variation of average power rating with ambient temperature. For cold climates, additional uprating is possible. However, if you're located in a moderate climate where the temperature may exceed 40°C (104°F), derate accordingly.



3. Derating factor for average power due to VSWR. High VSWR reduces the ie power-handling capability of transmission lines.

, and no solar load, but three : inner conductor temperature o nditions — 100°C (212°F), 2 6°F) and 120°C (248°F) — pressure conditions — atmo- ressure and 15psig — have med by various manufactur- ourse, the higher the inner temperature allowed, the average power rating for the on line will be, other things al. Higher pressure also in- ed peak and average power.

Uprating for rigid coax

he average power rating e a safety factor per se, pends on how much bullet associated travel you are ow. The usual failure mode ullet-type coaxial lines is bullet from overheating. station signs off and on tter the inner conductor, e bullet will travel each eases the amount of rub- llet or watchband spring, ct pressure and acceler- lup of metallic particles Eventually, enough met- to cause contact melting l line burnout. Because of this, long-term operation of coaxial lines at elevated temperatures is not recommended.

• **Uprating average power for higher inner conductor temperature.** As mentioned, manufacturers rate their rigid lines for average power by using different inner conductor temperatures. When the inner conductor is allowed to run hotter than 100°C, more heat is transferred. The increase in allowable average power follows the same curve for all diameters of 50Ω and 75Ω line.

The uprating factor, P'/P, is 1.04 for an inner conductor temperature of 102°C and 1.38 for an inner conductor temperature of 120°C. If you elect to run the line at one of these higher temperatures, uprate a line rated at 100°C by multiplying the manufacturer's average power rating by the P'/P factor and a line rated at 102°C by the P'/P factor for the new temperature divided by 1.04 (for 120°C, the P'/P factor = 1.33).

A cautionary note: Transmission line that is rated by the manufacturer for operation at 120°C inner conductor temperature has recommended cutback dimensions appropriate for this temperature. If line rated at a lower temperature is to be run at 120°C, *or if 120° rated line is to be connected to any existing run (in-building, etc.)*, cutback dimensions must be increased accordingly, unless you are using a thermally-compensated line with a bellows or corrugated inner conductor, in which case the bullet never moves or is absent entirely. If not sure what dimensions to use, check with the manufacturer.

• **Uprating for increased line pressure and SF_6 gas.** Nearly every manufacturer rates its line for average and peak power at atmospheric pressure. However, be-

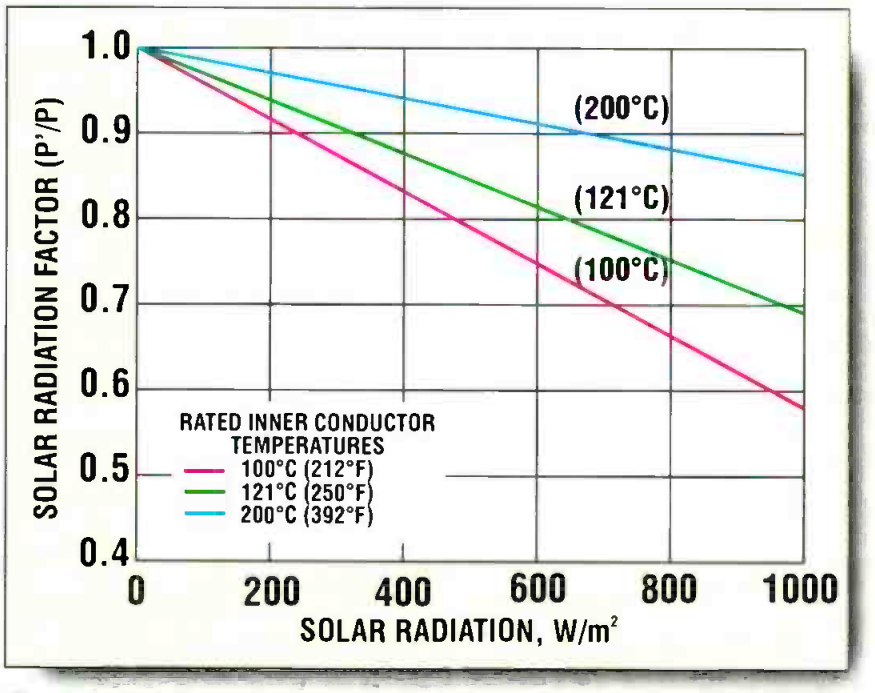


Figure 4. Variation of average power rating with intensity of direct solar radiation. In sunny climates, the bright sun can result in additional line heating, reducing its power-handling capability.

cause one manufacturer recently published a bulletin including a standard condition of 15psig, check to see what condition is being assumed before uprating. Increasing pressure inside the line increases both the average power and peak power rating as shown in Figure 2 for 50Ω line. By far the biggest improvement is for peak power, but average power also benefits. When the line will be pressurized with dry air or nitrogen, the uprated average power may be calculated from the rating factors provided in Table 1.Using sulfur hexafluoride (SF_6) as a pressurization gas increases average power ratings substantially but this is rarely done anymore because of personnel safety issues and added expense. If SF_6 is an option for you, estimate the P'/P factor from Figure 1.

UPRATING AVERAGE POWER BY INCREASING LINE PRESSURE

PRESSURE (psig)	P'/P FACTOR, 50 Ohm LINE	P'/P FACTOR, 75 Ohm LINE
0	1.00	1.00
5	1.09	1.08
10	1.16	1.15
15	1.21	1.22
20	1.26	1.28
25	1.31	1.33

Table 1. Average power uprating factors for pressurization with dry air or nitrogen. Increased pressure results in more power-handling capability.

Warning: Any dense gas can displace air and cause asphyxiation, and voltage breakdown in sulfur hexafluoride can create toxic oxides of fluorine.

• **Uprating/derating average power for lower ambient temperature.** If the ambient temperature for the antenna site is not expected to reach the rating temperature of 40°C (104°F), a further uprating can be made. This is shown graphically in Figure 2. However, if the temperature may *exceed* 40°C, you must derate the adjusted average power similarly.

• **Uprating average power for special emissive coatings.** Another trick that can be done to improve average power capacity is to paint the outside of the outer conductor with high emissivity white paint. (White is required to minimize solar absorptivity.) A total emissivity of 0.8 to 0.95 is achievable, compared with 0.04 to 0.07 for bright copper. However, once the copper oxidizes, its emissivity rises to above 0.8. If we assume that we can uniformly coat the outer conductor with paint having a total emissivity of 0.85 and a solar absorptivity of 0.30, average power can be further uprated by 28% for 50Ω line or 23% for 75Ω line. This technique has been used successfully for transmission line for short-wave stations in rural locations but obviously carries some risk in areas subject to particulate or acid pollution. If this is the only way to get on the air, contact a qualified heat transfer consultant for appropriate emissivity and absorptivity values for various coatings and contact the coating manufacturer for recommended maintenance interval.

A variation of this technique is a new transmission line introduced at NAB '98 that uses a proprietary process to improve the emissivity of the inside of the outer conductor and the outside of the inner conductor. The manufacturer has given no details as to the nature, emissivity or permanence of the treatment, so it is not possible to discuss it. If considering use of this rigid line, compare it with standard line under the same rating conditions to determine what benefits to expect.

• **Uprating peak power by reducing safety factor.** For peak power, uprating depends on how much of the manufacturer's safety factor you are willing to use up. Equation 3 shows that the rigid-line safety factor of two results in 2^2 in the denominator or a total safety factor of four on peak power. Even this is conservative, because the numerator includes the production test voltage, E_P, which is set at only 35% of its theoretical value. In other words, the actual peak power capacity of a perfect line is 11.4 times higher than rated.

So why are rigid-line manufacturers so conservative with their peak power ratings? First, manufacturing a perfect line is impossible; the tubing used is not exactly straight, and it always has some allowable warp. There is a certain amount of inner conductor sag in horizontal runs. Elbows are required. Moisture may enter the line. Tuning slugs or fine matcher screws may be incorporated after manufacture to improve system VSWR. Finally, voltage breakdown is a highly variable phenomenon that can occur at widely different values, depending on tiny flaws, such as scratches and dust particles.

Still, a safety factor of 11.4 is probably overkill and relates more to decades-old tradition in the broadcast industry than to hard engineering requirements. Slightly exceeding published peak-power ratings can probably be done without undue risk. Remember, though, that a single failure due to arc-over typically causes permanent damage to the transmission line and loss of signal.

The several uprating factors discussed are essentially independent and can be combined to determine the adjusted power ratings for your situation. But you can't stop here. In the past, broadcast engineers have tended to be rather casual about figuring *deratings* for transmission line, because they allowed plenty of operating margin. If you decide to take your line up to the uttermost limit, though, examine every derating factor.

• **Derating the power-handling capability.** The first step is to look at average and peak power based on modulation and VSWR. The *uprated average power* rating must be derated for VSWR using the derating factor, D.F.:

$$D.F. = \frac{(VSWR)^2 + 1}{2(VSWR)} + \frac{F^1(VSWR)^2 - 1}{2(VSWR)}$$

Equation 5

F^1 = frequency and line size factor from Figure 3.

The calculation of derating factor is conservative in that it assumes that all reflected power is re-reflected at the transmitter and that absorption of the reflected signal by the attenuation of the line is small. Select F^1 from the applicable curve in Figure 4, calculate D.F., and *divide* into uprated average power.

Uprated peak power must also be derated for the effects of modulation and VSWR. These deratings are calculated as follows:

DTV:

$$P_{max} < \frac{P_{pk}}{VSWR}$$

Equation 5

Analog TV:

$$P_{max} < \frac{P_{pk}}{(1 + AU + 2\sqrt{AU}) * VSWR}$$

Equation 6

where

P_{max} = derated maximum peak power
M = amplitude modulation index (100% = 1)
AU = aural to visual ratio (20% aural: AU = 0.2)

Note: For DTV, P_{max} should be compared to the +6 dB peak power levels for 8VSB and not the average power of the signal.

• Derating average power for direct solar radiation. Transmission line exposed to direct solar radiation has reduced average power-handling capability due to the additional heat from the sun. The solar radiation derating factor, P'/P, is provided in Figure 4 for solar radiation, in W/m², incident *normal* to the transmission line. As a conservative estimate for moderate climates, an average radiation intensity of 300 W/m² can be used. For hot, dry climates, the solar radiation intensity can exceed 1,000W/m² at the hottest time of the day. *Provided that absolute maximum temperatures are not exceeded*, the mean value over the day, which is a little less than 400 W/m², is more applicable for solar derating.

To be more precise, you need to look at expected mean solar radiation at the antenna site and the actual angle of incidence. For the United States, the National Meteorological Center has developed a map showing average daily direct normal solar radiation (see Figure 5). The data on this map is expressed in MJ/m²/day, so to convert to direct W/m², you need to multiply by 11.54; e.g., an area with an average daily radiation of 10 MJ/m² would have direct solar radiation of 115.4 W/m². Find your antenna site, note the radiation shown (taking the higher value of the lines encompassing your site) and — to be conservative — multiply by 11.54.

You can also reduce the solar load by a factor based on the actual angle of incidence. Your transmission line run will generally have two components, a horizontal run and a vertical run. The horizontal run will in fact receive radiation close to normal incidence if the sun is high in the sky, so you may elect to erect sunshields for it to increase power. In that case, only the vertical run will remain exposed. Estimate the worst-case elevation angle of the sun based on: 1) the latitude of the site, 2) the season, and 3) the time of day. Take the cosine of this angle of incidence, measured from the direction normal to the transmission line, and multiply it by the average daily direct normal solar radiation prior to converting to W/m².

Finally, read the solar radiation factor P'/P from Figure 4 for the inner conductor temperature that you plan to use (the 121°C curve is close enough for 120°C operation) and multiply this P'/P factor by adjusted average power.

• Derating peak and average power for altitude. A final derating — that for altitude — is done even more rarely. As mentioned, most manufacturers rate their rigid line for atmospheric pressure, and that means atmospheric pressure at sea level. This impact is more severe for peak power than for average power. Select the P'/P derating factors from Table 2 for the altitude above sea level, interpolating as necessary, and multiply by the adjusted average power and peak power ratings. Table 2 assumes nominal overpressure in the line, but in fact, you should have some excess pressure.

DERATING AVERAGE POWER AND PEAK POWER FOR ALTITUDE

ALTITUDE, ft above sea level	P'/P AVERAGE POWER	P'/P PEAK POWER
0	1.00	1.00
5,000	0.92	0.83
8,000	0.87	0.73
10,500	0.84	0.66
15,000	0.78	0.55

Table 2. Average power and peak-power derating factors based on altitude. The higher the altitude, the lower the power-handling capability of a transmission line.

Coaxial cable

Though solid and foam dielectric cables are available, most DTV applications will require the use of air dielectric coaxial cable to carry enough power, so air cable is assumed here. Standard rating conditions for cable are similar to those for rigid coaxial line, except that the safety factor on peak power is 2 instead of 4. The main difference is the variety of dielectric materials used: polyethylene, polyolefin and fluoropolymer. The latter two materials have higher operating temperatures and are used to increase the power rating of the cable. Generally, cables are rated for an inner conductor temperature of 100°C for polyethylene dielectric, 121°C for polyolefin, and 150°C for jacketed fluoropolymer (unjacketed fluoropolymer dielectric cables, not suitable for TV main feeders, are rated at 200°C). However, one manufacturer published a bulletin last year using average power ratings based on an inner conductor temperature of 115°C for polyethylene dielectric cables, so be sure to verify the standard rating conditions before doing any uprating.

• Uprating average and peak power for higher inner conductor temperature, increased pressure, SF_6 gas and lower ambient temperature. Uprating average power depends on how much shortening of cable life you can tolerate. The average power rating for a cable is set so as to limit the inner conductor temperature to a level that allows a satisfactory life of 20 years (typically). Clearly, running a cable hot enough to cause melting — or even softening — of the dielectric is unacceptable. While the polyethylene materials used in coaxial cables have melting points around 130°C (266°F), the operating temperature needs to be significantly lower than this to limit the

Transmission-line trade-offs for DTV

long-term degradation of the dielectric by oxidation. Even with less than 1% oxygen in the atmosphere, dielectric materials react chemically with it at elevated temperatures, ultimately degrading their electrical and mechanical properties. Dielectric loss increases, and the plastic turns brittle; this can lead to decentering of the inner conductor and line burnout. Like all chemical reactions, the rate increases substantially with quite modest temperature increases. Typically, the rate of oxidative degradation increases, and lifetime decreases by about a factor of two for each rise in temperature of 10°C (50°F).

So an increase in inner conductor temperature will accelerate oxidation of the dielectric and shorten cable life. You can estimate this effect for a polyethylene dielectric cable from Figure 6. As can be seen, for a maximum inner conductor temperature of 100°C, oxidation proceeds slowly enough to assure a cable life of approximately 20 years. However, with the inner conductor temperature raised only to 115°C, cable life is cut by almost two-thirds, to 7.1 years. If you find five years acceptable, you may be able to crank the power up so that the inner conductor runs at 120°C (however, this is getting into the softening area, so stopping at 115°C is probably a good idea).

Intentionally running the line so hot that you have to replace it in five years may be preferable to not broadcasting at all.

Polyolefin dielectric cables should probably be left alone, but fluoropolymer dielectric cables have plenty of margin left at their rating temperature of 150°C. We tested a sample of our high-power fluoropolymer dielectric five-inch cable at an RF average power of 3318.9kW (over 196% of rated peak power) at 0.5MHz and at 60.3kW (112.5% of rated average power) at 700MHz, Channel 52, without damage to the cable or its jacket. (Note: These RF average power levels are typically 10–20% higher than average powers calculated using a 60Hz test.)

Unjacketed fluoropolymer dielectric cables are actually rated for an inner conductor temperature of 200°C. The limiting factor is bullet travel, rather than temperature; while coaxial cable doesn't have the multiple failure points of rigid coax, there may be rigid line connectors with bullets somewhere in the transmission path (bullets in the connectors for the cable itself should not move because of the cable's corrugations). Estimate the increased power to be obtained from a higher inner conduc-

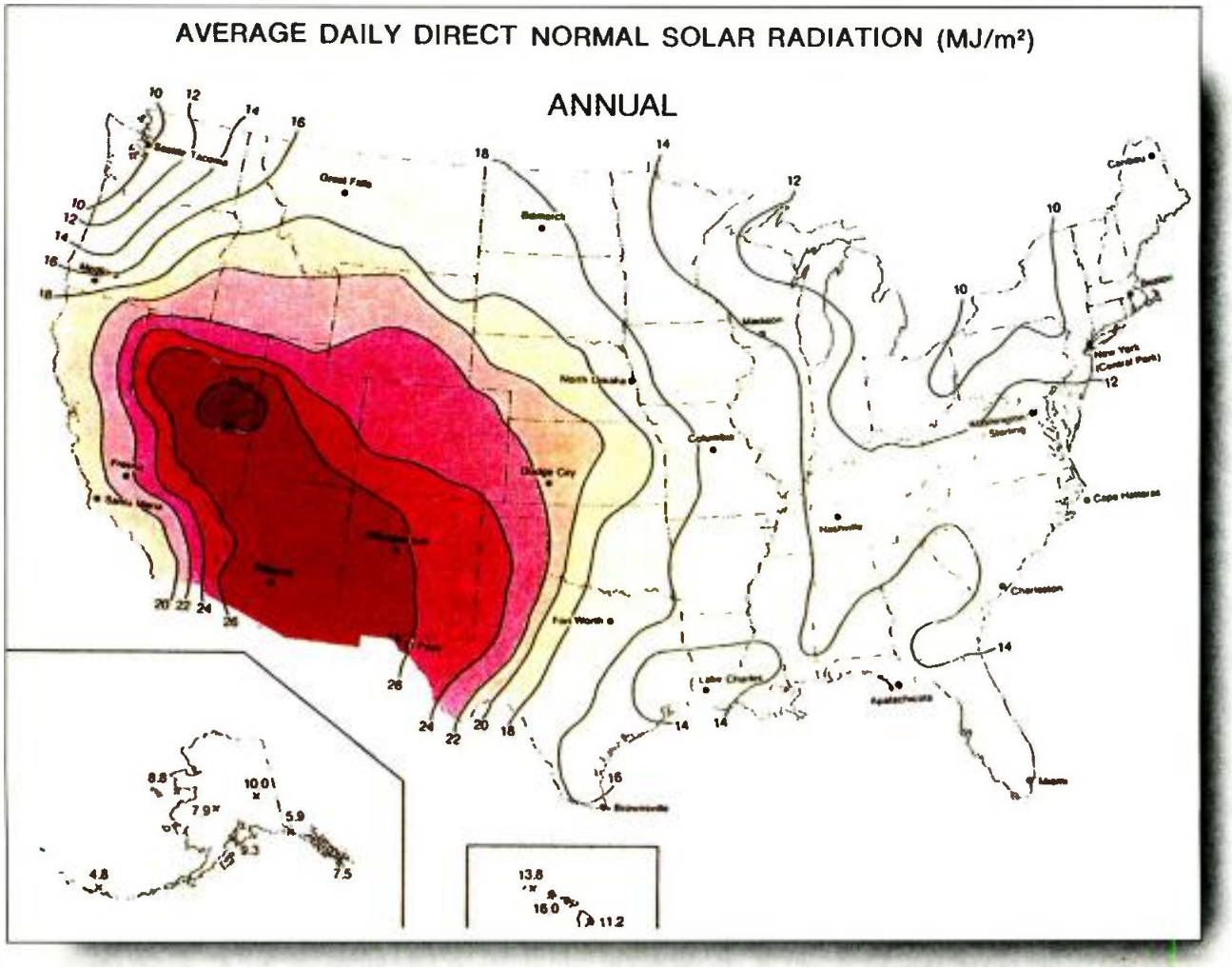


Figure 5. Average daily direct normal solar radiation (MJ/m²). Map courtesy of National Meteorological Center, Washington, D.C.

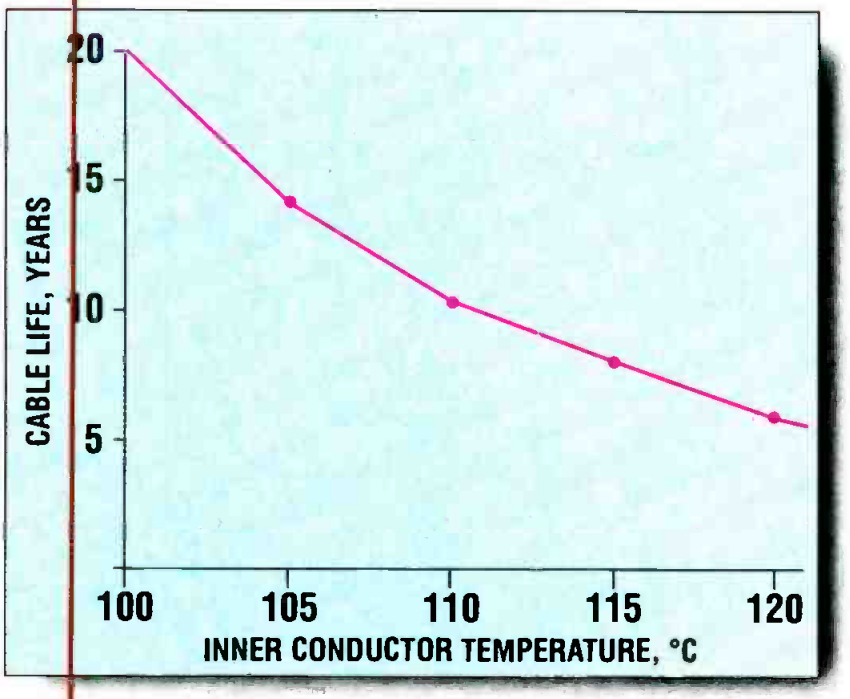


Figure 6. Approximate reduction in cable life based on increased inner conductor temperature. Within some limits, the choice comes down to a trade-off between shortened life and more power-handling capability.

tor temperature by taking the increase over ambient temperature at the new inner conductor temperature divided by the increase over ambient at the rating temperature.

The steps for uprating for increased line pressure, SF_6 gas and lower ambient temperature are identical to those discussed in the rigid line section. See above for guidance on calculating these uprating factors for coax.

- **Uprating peak power by reducing safety factor.** Uprating for peak power depends on how much of the manufacturer's safety factor you are willing to use up. For coaxial cable, however, the peak power safety factor is only two, and the production test voltage is slightly higher than 35% for some cable sizes, so the total safety factor is closer to 5 than 11.4. But experience shows that slightly exceeding published peak power ratings is not too risky. If you overdo it, though, you'll destroy the entire feeder run.
- **Derating for modulation and VSWR, solar radiation, and altitude.** You'll need to derate your power capacity estimates for these factors just as for rigid line. See the sections on rigid line for guidance in calculating the derating factors. You will use Figures 4, 5 and 6 along with equations 5, 6 and 7 to calculate the result.

Is it worth it?

Let's take a real-life DTV example and see if all this engineering knowledge can get us out of trouble. Our example station is located in upstate New York with an ERP for Channel 51, 693.25MHz, of 1MW. We have to install a 25 gain antenna, so we must deliver 40kW to it. We think that we can achieve a VSWR of 1.05. Our transmission line run is 600 feet long total. If it is 70% efficient, the transmitter must deliver 57.1kW into it. Upon checking manufacturer's ratings, this looks like a job for 6 1/8-inch, 50Ω rigid line.

The problem is our tower will never hold another run of line this big. So let's see if 3 1/8-inch, 50Ω line might work. It meets the 70% efficiency requirement under rated conditions. Because this line will carry only one channel, peak power is not an issue. The average power rating is a dangerously low 18.6kW for an inner conductor temperature of 100°C and atmospheric pressure.

We'll raise the inner conductor temperature to 120°C, pressurize with 25psig of sulfur hexafluoride, assume an ambient temperature of no more than 35°C, shield the horizontal run and paint the vertical run white. This puffs our 18.6kW all the way up to 63.96kW, a good start. For 693.25MHz, the F^1 factor is practically zero, so the D.F. derating factor for a VSWR of 1.05 is only 1.0012, cutting average power to 63.88kW. Average daily direct solar radiation is just 10 MJ/m^2 or 115.4 W/m^2. Applying the cosine of the latitude, about 0.7355, reduces this to 85 W/m^2. This gives us a P'/P factor of 0.97 and a derated value of 61.96kW. Finally, our altitude is around 2,500 feet above sea level, so we'll subtract another 4% and arrive at an adjusted average power rating of 59.5kW — higher than needed. (Ignored in this example is the effect of higher attenuation at the hotter temperature on efficiency, that you would need to calculate.)

Does this mean that you can go around substituting three-inch line for six-inch line? Probably not, because your conditions aren't likely to be as favorable as these. Also, any change in operating conditions such as pressure loss, increased VSWR, wind damage or unseasonable heat can result in total failure of the line. Because this means off-air time and damage repair expenses, you probably wouldn't care to push the limits quite this far. But if big line just won't work, you may be able to use 4 1/16-inch rigid line or large diameter coaxial cables — under less severe conditions — in order to get on the air during the first few years of DTV implementation. ■

Cautionary note: Operating a broadcast transmission line above its rated power value may void the warranty. Contact the manufacturer for further information. Neither the author, Andrew Corporation, nor *Broadcast Engineering* shall be responsible for problems arising from use of the information presented in this article.

Acknowledgments: The author would like to thank Kerry Cozad, Andres Gonzalez, Hugh Nudd and Tom Mikolajewski of Andrew Corporation; and Phil Cindrich, Don Aves and Steve Kolvek of MYAT Inc. for their valuable help in the preparation of this article.

Bob Leonard is product manager, broadcast transmission-line products, at Andrew Corporation, Orland Park, IL. Readers may obtain additional information in the form of two detailed technical papers, "Selecting a Transmission Line for Your Broadcast System," and "New Attenuation and Power Ratings for Broadcast Transmission Lines," by calling Andrew at 1-800-255-1479, extension 372; ask for SP50115 and SP50177.

Understanding HD/SD conversion

Get ready to convert – almost everything!

By Kenneth Hunold

Nov. 1 is looming large on the horizon for engineers and managers at many TV stations and the networks. That is the date stations in the top 10 markets have volunteered to be on the air broadcasting digital TV signals.

According to most plans, at first there will be only a few hours per week of programming originating in an HD format. What about the rest of the broadcast day? Much of what is broadcast on the NTSC channels will require upconversion to an HD scan rate for broadcast as HD programming.

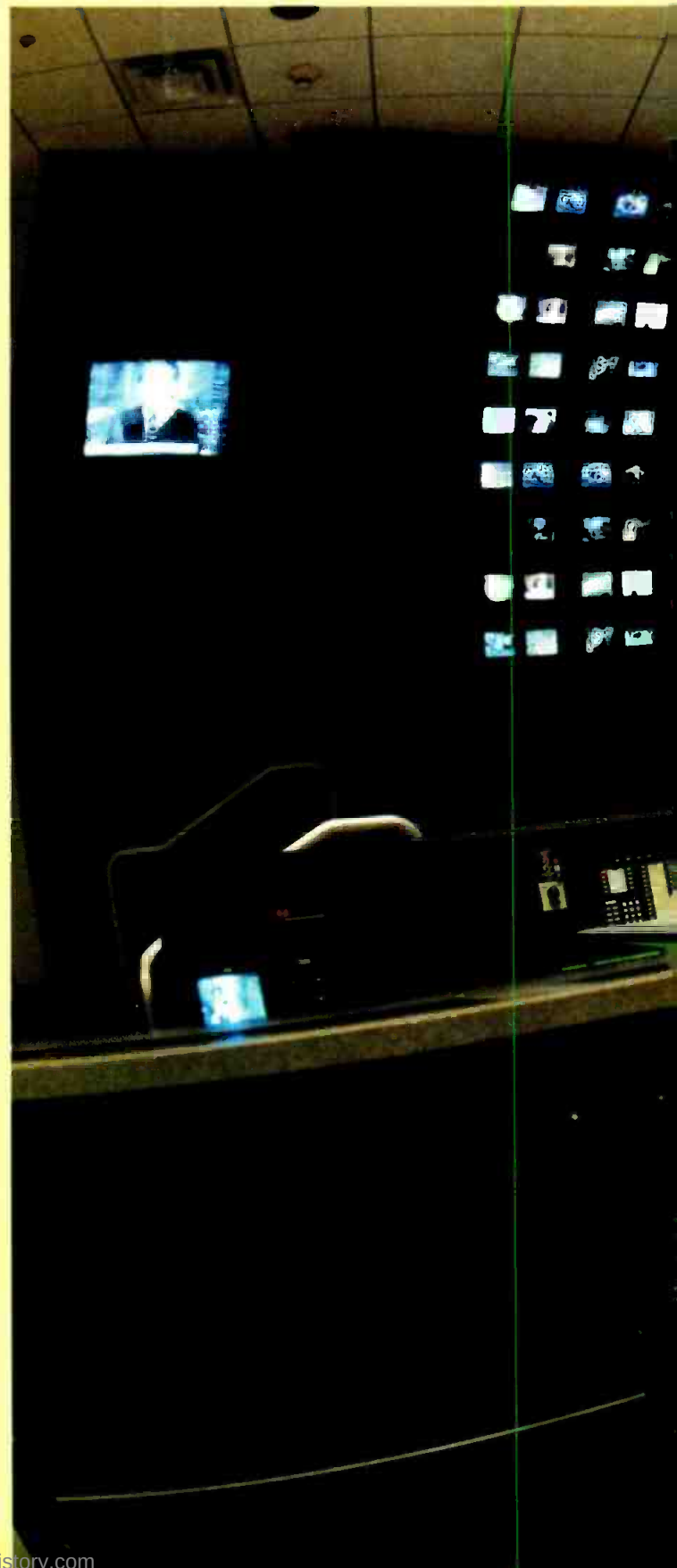


Photo: Leading program suppliers, like DirecTV, are moving quickly to provide their customers with HD and widescreen services. This photo shows the DirecTV network monitoring center that provides simultaneous signal monitoring and analysis for more than 375 program channels. In the upper right corner, note the use of 16:9 professional monitors. (Facility built by and photo courtesy of Communications Engineering Inc., Newington, VA.)

In the future, what about those hours that are being originated in high definition? Surely most HD originated material will end up being broadcast on the NTSC station, requiring another type of conversion.

HDTV doublespeak

Perhaps the first thing to discuss is not technology, but terminology. What are we going to call these conversion devices? It is almost intuitive that converting from a scanning rate with less scanning lines to one with more scanning lines would be called upconversion, while converting from a format with more scanning lines to one with less would be downconversion. Although technically correct, this explanation can raise some political issues. On this continent, we do not refer to the conversion from 525-line NTSC to 625-line PAL as upconversion. Nor do we consider converting from 625-line to 525-line downconversion. In the interest of political correctness, let's try to

set some protocols.

Conversions from any of the existing SD line rates (i.e., 525 and 625 total scan lines) to any of the new HD line rates (i.e., 720 or 1080 active scan lines) should be referred to as upconversion. The infamous ATSC Table 3 can help us here. In the interest of avoiding a fight, devices that convert between (or among) HD formats should be called cross converters or simply converters.

Interpolation process

These complex conversions, along with some other more subtle ones, are not trivial. A tremendous amount of engineering effort goes into developing high-end HDTV converters. The most obvious function of upconversion is to increase the number of scanning lines in an image. The almost generic term — line doubler — refers to a device that merely repeats every line to reduce the visible scanning structure on large displays. Most modern upconverters use a more elaborate process of interpolating between scan lines to approximate the image that would have been between the scan lines. This is more in keeping with the philosophy of attempting to display a 525-line image as if it were scanned at a higher line rate. Which is, after all, what we are attempting to do.

This interpolation is similar to what is done in a 525- to 625-line standards converter. In fact, an HD converter can be thought of as a standards converter on steroids. In both cases, an output scan line must be synthesized from varying portions of the input lines adjacent to it. Depending on the spatial position of the output line relative to the input lines, the output line will look more like the input line above or below it. It could happen that the output line exactly overlaps the input line. Then the solution is easier — the input line just needs to be passed to the output line (in addition to computing any changes in line length).

A high-definition converter can be thought of as a standards converter on steroids.

Interlacing and frame rates

Central to the issue of comparing input and output scanning functions is recreating the image that was originally scanned. This is where interlace scanning causes problems. In an interlaced system, a temporal difference exists between the two fields because they are not scanned at exactly the same time. To recreate the original scene, an interlaced frame must be de-interlaced to return to the original scene that was captured. If the two interlaced fields are combined, an artifact occurs, caused by the temporal offset between the fields. A rigorous treatment of the issues surrounding interlace and progressive scanning is outside the scope of this article, but suffice it to say that building a good de-interlacer is not a trivial process. It is possible that, when converting from interlaced standard definition to interlaced high definition, the odd and even interlaced fields could be interpolated separately, but that ignores the advantage of having the in-between scan lines available in the next field (even with a possible temporal offset).

Once the original frame is recreated, you can theoretically compute the new output frame. But, of course, there is more. Most SD video formats have a 4:3 aspect ratio. All of the HD formats have the wider 16:9 aspect ratio. Artistic decisions must be made about how these two images will be processed. The term aspect ratio converter is a misnomer because aspect ratios cannot be converted. The best that can be done is to accommodate one aspect ratio on another.

Many schemes have been devised to fill a 16:9 frame with a 4:3 image (and vice versa). If true proportions are to be maintained (sometimes referred to

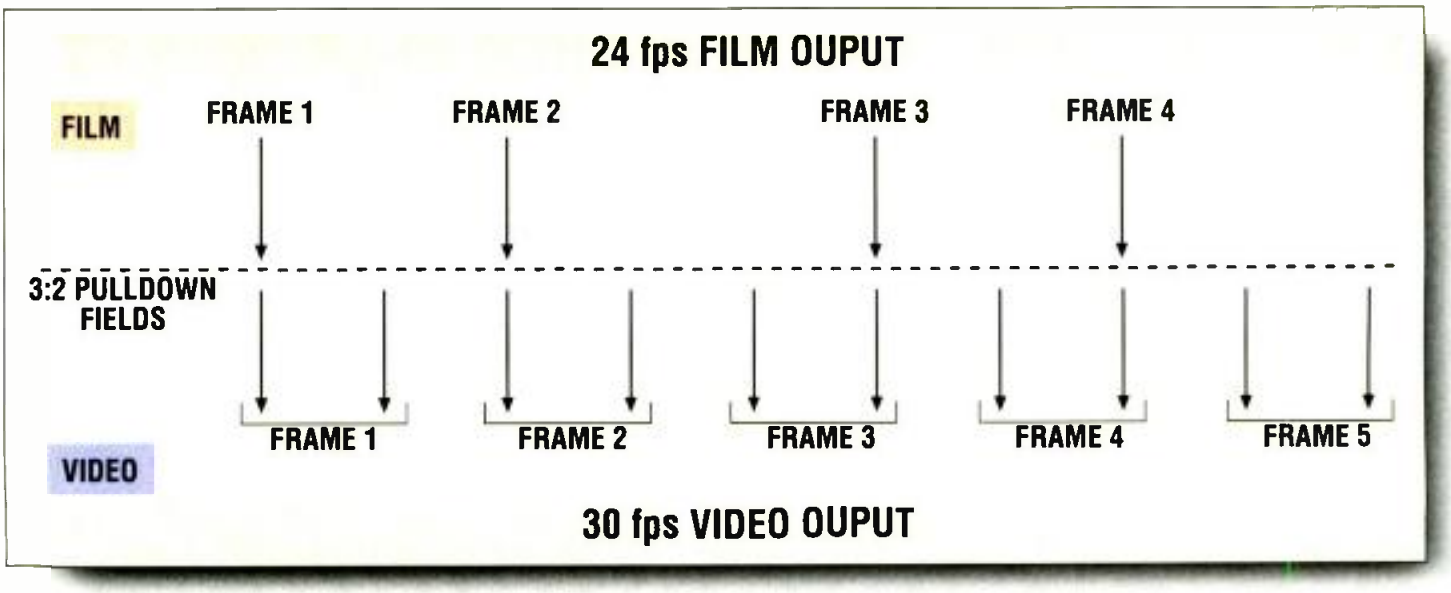


Figure1. Because the frame rates of film and video are not the same, a conversion must be made. The illustration shows how an input rate of film's rate of 24fps is converted to a video output rate of 30fps. The first film frame is held for three video fields and the second film frame is held for two video fields. The sequence is then repeated. This results in four frames of 24fps film producing five frames of 30fps video.

With a large infrastructure of NTSC and a November deadline, the networks are faced with a huge challenge in converting their facilities to HD in a short timeframe. Shown here is an NBC news control room in Washington, DC. Most stations will initially have to rely on NTSC-to-HD upconverters to generate high-definition signals. (The NBC facility built by and photo courtesy of Communications Engineering Inc., Newington, VA.)

as circularity), then the choices range from full height (with side curtains or panels) to full width (with the top and bottom of the image cropped). From the interpolation viewpoint, full height is preferred over full width because full width zooms the image up more, highlighting any interpolator errors as well as emphasizing the lower resolution of the SD source compared to other HD sources.

More for less

Can these images be enhanced or made to look better than they actually are? Within reason, yes, but with an emphasis on the phrase "within reason." Why? Because the images actually aren't really any better. Processes similar to SD image enhancement can be performed, but often more choices of parameters exist. Remember that any enhancement will be magnified on a larger display along with the magnified image. This problem might also explain why greatly enhanced SD images do not convert well to HD. What was thought to be subtle enhancement on an SD image might become objectionable when displayed in HD.

HDTV uses different equations than NTSC to create luma and chroma values from RGB signals.

Just as with a camera-originated picture, some compromises must be made based on image content. If the converter has an autosetting, it is a good place to start. Artistic judgment must be exercised. If you have a video person or a maintenance person who is good at matching and adjusting cameras, let him adjust any enhancement controls while viewing the output on a good HD monitor.

If the converter is going to operate on a variety of video program types or will

Management

What's not revealed is often most revealing

BY KARE ANDERSON

You never really know people until you see the choices they make. As a broadcast engineer, you've probably found that it's usually not the "technical" challenges but the "people" challenges that determine how well you can do your job. We instinctively pigeonhole people into categories to make the world more understandable, and then we're surprised when a co-worker exhibits a sudden vehemence about a new subject.

You can have fewer surprises, however, when you seek to understand others' less visible, underlying motives, and you may find easier, more satisfying ways of working with them.

Everyone has their own operating manual

To better understand people and find out how to inspire them to take positive action, learn to recognize their unstated hot buttons of high emotion, positive or negative. These are the major rules to a person's "operating manual" — what makes him or her run smoothly, bump into obstacles or simply get stuck. People act quickly and intensely to avoid what they fear. That's because our deepest gut instinct is to survive. We reflexively react to any danger.

To recognize a person's hot buttons, look for changes in their behavior as signals that you are on a hot topic of concern. Facial expression tells others how we feel, and our bodies suggest the intensity of our feelings. Look for the "vital signs" of increased excitement, such as dilated pupils, a higher or thinner voice, rapid blinking, flushed face, rapid and shallow breathing and avoidance of direct eye contact in someone who had looked you in the eye earlier in the conversation. In people who usually move and gesture little, look for rapid body movements. For people who tend to be more animated, look for the times when they are moving less than usual.

In times of increased concern, women are more likely to move their hands and forearms more. When seated, men tend to show their feelings by twitching one foot when their legs are crossed. In general, in times of conflict or other kinds of tension, women tend to move and talk more; men tend to move and talk less. Psychiatrist Pierre Mornell

wrote a book about this phenomena called *Passive Men and Wild, Wild Women*.

Few people are aware of how dramatically bodies shut down in times of perceived crisis or unfamiliar situations. In times of fear or even mild discomfort, people have diminished hearing. In addition, their peripheral vision and their ability to taste can also decrease.

In "shut-down" situations, people hamper their ability to perform, and others may misinterpret their slowed reactions. You may see the pattern in someone else's hot buttons even though they do not perceive them. In the case of people who are close to you at home or work, it pays to recognize their unstated warning signs — if you appear safe and familiar to people, they can be more open to hearing you.

Once you recognize what happens when people get upset, you can come closer to understanding their operating manuals. This understanding allows you to present your ideas in ways that address their concerns, either directly or indirectly. Thus, you can influence someone to take action to avoid a perceived danger.

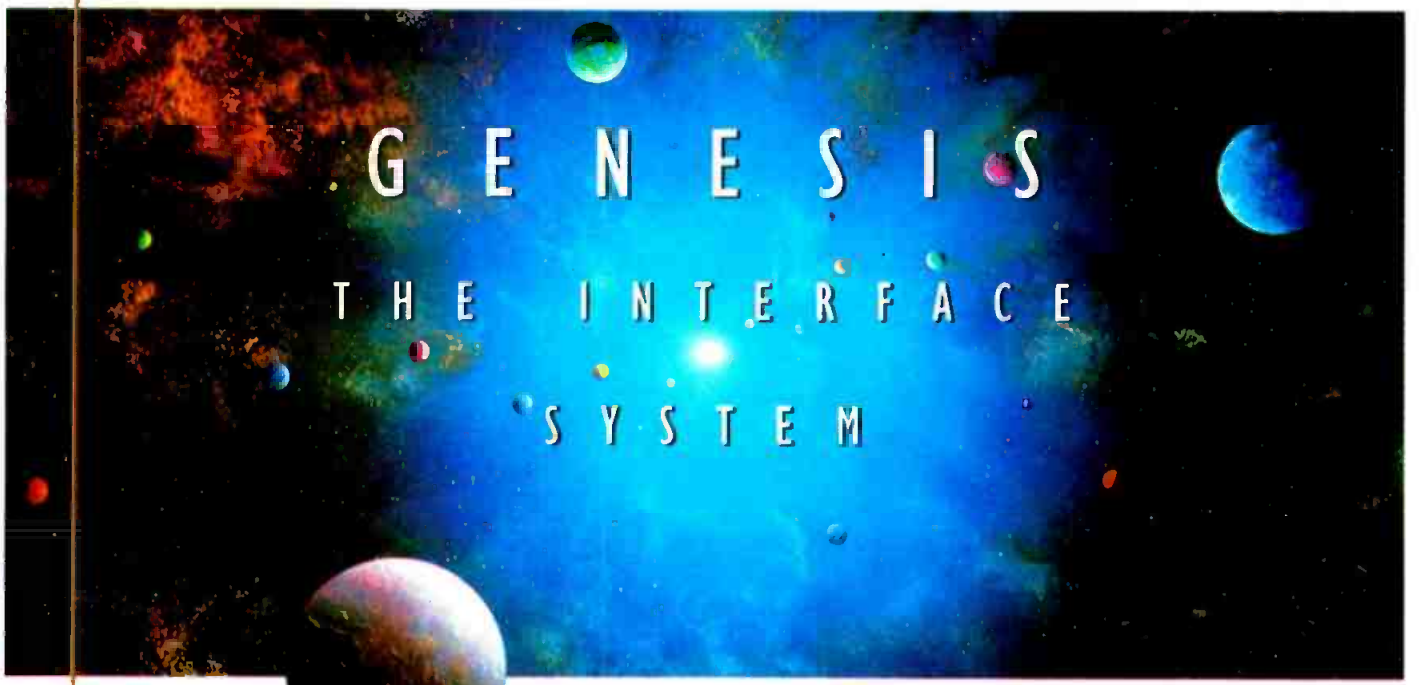
Many times, we are not aware of our underlying fears or concerns. We can go through life in a trance, reacting to earlier patterns, especially negative experiences, without knowing that we are not acting in our best interests.

Questions tell more than answers

We are far more revealing by the questions we ask than the answers we give. We are taught to ask questions to show interest and learn more about another person, but we will learn more deeply and quickly when we get that person to ask us questions. How? Explain something that engages their interest so that they ask questions to learn more. Respond directly, but briefly, to their questions so they are in charge and ask follow-up questions. Note the direction that the other person's questions take.

On average, by the third question, you will know more about the nature of someone's deeper concern or interest than if you had taken charge. Why? Because you don't know what you don't know. Your line of questions will be based on your world view. Their line of questions will reveal their world view. ■

Kare Anderson is a speaker and author. Visit her web site at www.sayitbetter.com.



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Applied Technology

Tubes for DTV

BY GUY CLERC AND MICHEL LANGLOIS

The 1990s will go down in the history of television as marking the advent of digital broadcasting. Thanks to extensive work by many different people, modulation standards have been set, characterization methods defined and quality standards established.

At the same time, Thomson Tubes Electroniques of France has developed a new line of tubes specifically designed for DTV. These new tubes can also be used for analog broadcasts at up to 60kW in common amplification. Thomson Tubes Electroniques' IOTs and Diacrodes now offer the highest power and best linear performance on the market.

Without additional measurements, however, no currently available method allows us to transpose tube capabilities from the analog to the digital environment.

In the meantime, a consensus has emerged concerning the methods used to characterize digital signals. Today, it is possible to measure the intrinsic qualities of electron tubes for 8VSB operation. This articles will show how engineers at Thomson Tubes Electroniques developed this approach, what it entails and the initial test results.

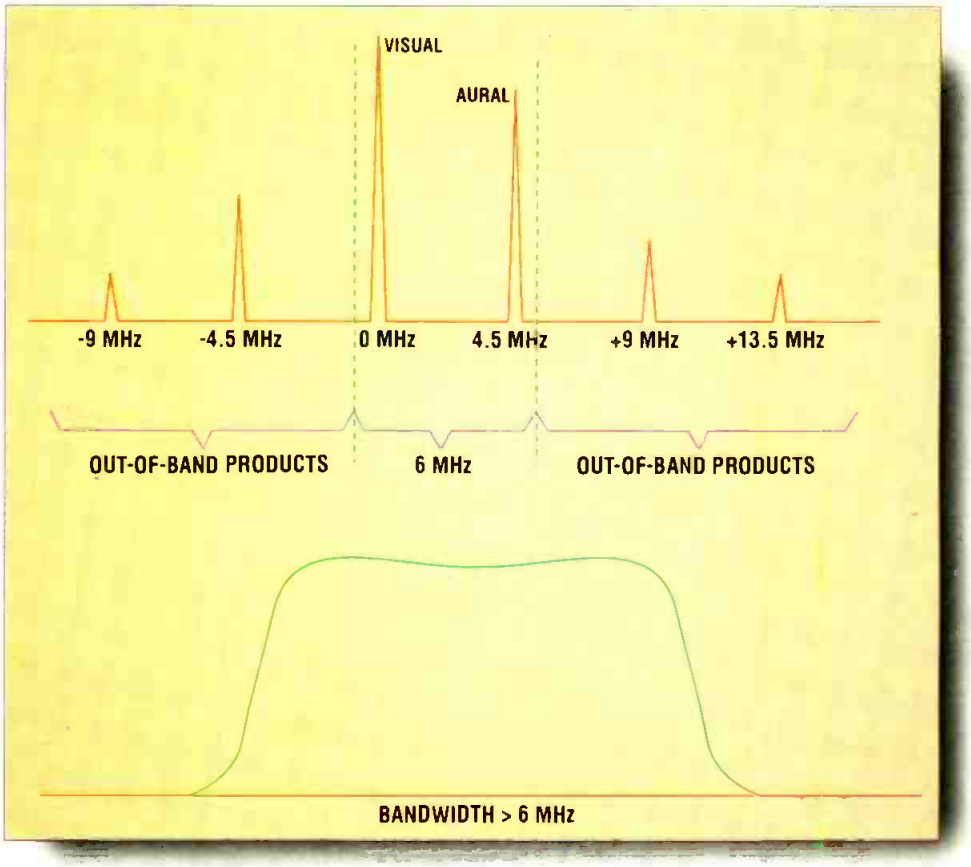

Figure 1. Typical analog measurements ignore the IM that occurs in adjacent channels because proper filtering can eliminate them.

Component performance with 8VSB signals

Tube performance in both analog and digital mode is largely determined by two factors: amplitude linearity and phase linearity. Even though these two key parameters remain the same, the methods used to characterize analog and digital signals are radically different (see Table 1).

For analog signals, the sum of the visual + aural signals is imperfectly corrected during the sync pulse, which means this peak envelope power cannot be used as a reference to calculate the capabilities of a given component for digital operation.

In general, measurements of analog signals do not take into account the visual and aural carrier intermodulation in adjacent channels (see Figure 1). However, with digital signals, out-of-band intermodulation products create a spectrum that is in continuity with the desired spectrum (see Figure 2), making it hard to attenuate these signals. Measurements show how closely the quality of the out-of-band signal (shoulder height) depends on the three parameters that characterize the signal in the channel passband: EVM, SNR and peak/average power ratio.

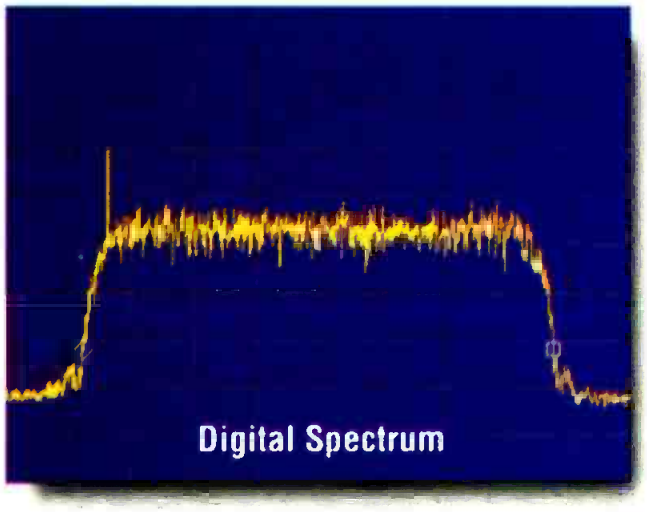

Figure 2. Shoulder height (DTV): With digital signals, out-of-band intermodulation products create a spectrum that is in continuity with the desired spectrum.

Shoulder height is currently considered the reference measurement, because it is easy to use and to analyze. Other measurement methods are applied concurrent-

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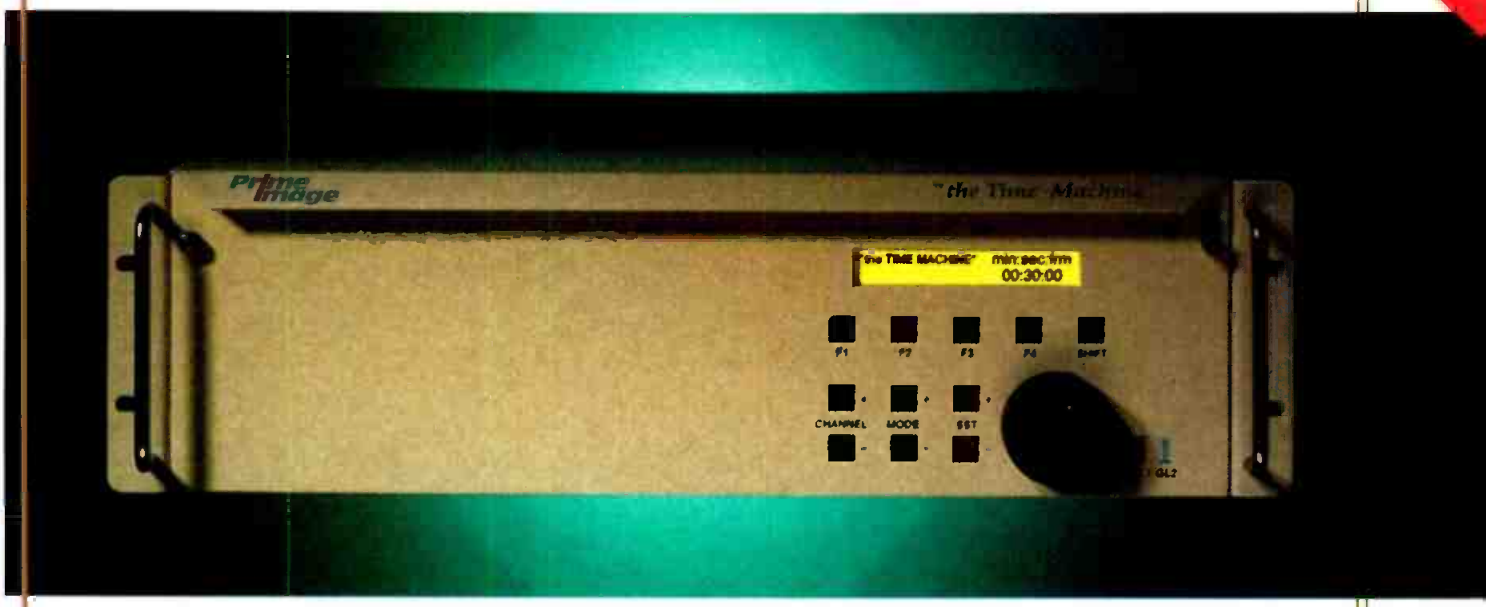

The Time Machine is a new, technological break through product, which reduces program time, to create commercial insertion time. it is a self contained, small 3U rack mountable unit which requires no data compression.

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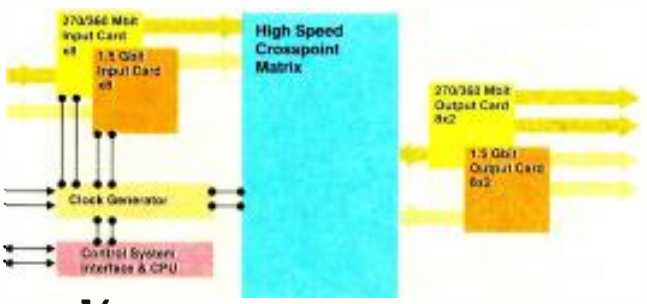
GOING FOR THE GOLD – NVISION Receives High Marks for its New *enVoy*™ Series of Universal Digital Routing Switches

As a long time leader in the digital audio market, NVISION is bringing its 'customer driven' formula for success to the video market with the ENVOY series of digital video routers. Since 1989, this Grass Valley, California company has earned a solid reputation for providing high quality/high value digital audio, time code and data routers to the television industry.

NVISION routers typically solve problems that have been ignored by other manufacturers. As proof of this statement, NVISION routing switches can be found in almost all of the Hollywood post-production facilities, as well as in major network operation centers around the world, with the majority of these switches operating under other manufacturers' control systems - and the ENVOY should prove to be no exception.

With 1998 seeing the start of DTV transmissions to the home, broadcasting organizations need to build systems that can include multi-channel NTSC, HDTV and surround sound. To accommodate these immediate requirements, the industry needs equipment that has the flexibility to fit today's needs, without being outgrown tomorrow. NVISION has anticipated this need for operational flexibility and has designed the ENVOY series with this in mind.



enVoy™ **Series Routing Switch, Block Diagram**

At the heart of this new router family is a high speed crosspoint architecture that will handle data rates in excess of 1.5 Gigabits. This structure is combined with various I/O modules to accommodate several data rates. ENVOY users will be able to route any standard rate SDI and HD-SDI signals, within the same switch – at the same time.

This fact, combined with the ability to control the switch from an existing control system, provides incredible power and flexibility.

With the ENVOY series, digital video routing is available at competitive pricing and a compact size: a 128 x 128 frame with dual outputs fits in a mere 16 rack units.

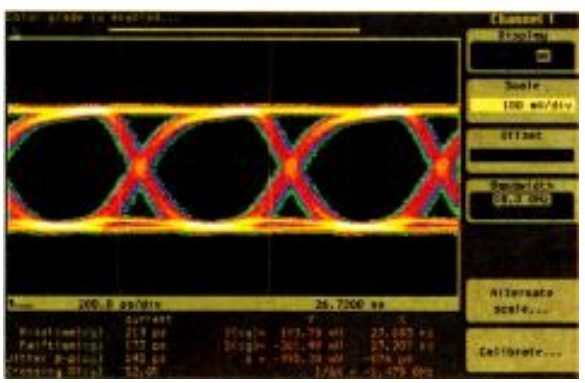


Figure 1. ENVOY 1.5Gbit data output after 75 feet of cable

Input and output modules include SDI (143, 177, 270 & 360 Mbits) and HD-SDI (1.5 Gbits) modules. Different I/Os can be included in the same switch, as can dual references to allow simultaneous dual standard 59.94 and 50Hz vertical interval switching. Output options include dual connectors for each destination, to minimize DA requirements.

NVISION's proprietary technology makes this universal digital video switch a reality, and at a remarkably low cost. In addition to these new technologies, NVISION has developed unique circuits for data reclocking, high speed internal interconnect, and cable driving. ***See Fig 1.***

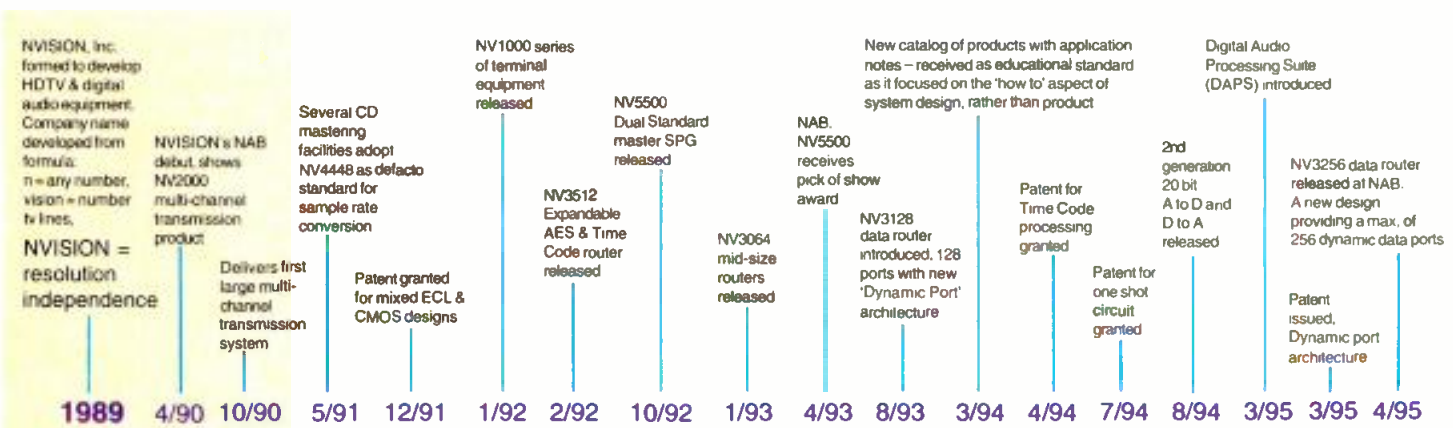
This new router series will enable users to purchase an expandable SDI router that can also have 1.5 Gbit HD added incrementally, as and when required. ■

ENVOY Series Routers

EN6064 11RU frame to accommodate up to 64 x 64 with dual outputs

EN6128 16RU frame to accommodate up to 128 x 128 with dual outputs

EN6256 23RU frame to accommodate up to 256 x 128 with dual outputs



CBS Selects ENVOY for HD-SDI Routing

CBS Network operations center in New York has purchased NVISION equipment for HD-SDI routing and distribution.

Scheduled for installation in September 1998, the initial package includes the ENVOY series 128 x 128 router frame and the 4000 series 1.5 Gbit fiber optic transmission equipment.

The ENVOY router has been chosen to provide the network operations center with an HD-SDI routing layer that will be controlled by a local NVISION panel network. This router is initially loaded as 32^2 and is expandable to 128^2 in increments of 8 inputs and 8 outputs. The router will be connected to local HD-SDI sources via coax with longer runs being distributed over 1300nm fiber optic cable.

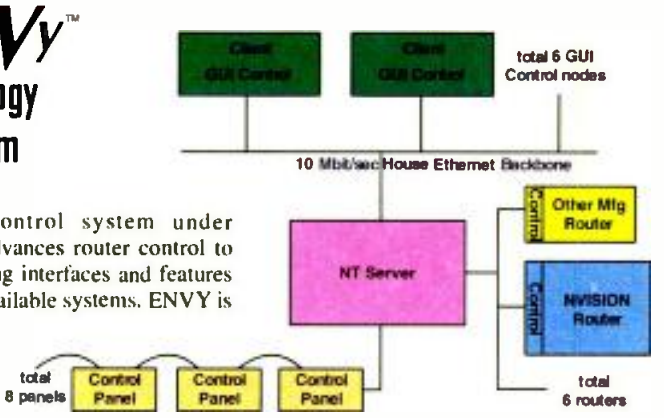
New 4000 series fiber optic transmitter and receiver modules have been included in this purchase to provide an affordable method of HD-SDI connectivity throughout the facility.

The ENVOY series will provide CBS with room for expansion as well as the ability to add extra SDI layers within the same switch, if desired.

The selection of these new NVISION products provides CBS with an affordable and flexible HD-SDI layer that is easily expanded as needs grow. ■

Green With enVy™
New Control Technology for the Next Millenium

ENVY, the new router control system under development by NVISION, advances router control to the next generation by providing interfaces and features that will supercede currently available systems. ENVY is being designed to replace current routing control systems for users who require far greater flexibility and operational ease than existing systems provide.



enVy™ Router Control System (Minimum Requirements)

ENVY Incorporates:

- Easy to understand GUI for configuration using industry standard database.
- Intuitive GUI for control allowing different modes for control and status.
- Easy to use, operator friendly hardware control panels.
- Intelligent routing and conversion through automatic tie lines.
- Standard hardware using Pentium PC technology.
- Standard operating and networking system using Microsoft Windows NT©.
- Controls all NVISION routers and will control many other manufacturers' installed routers.
- ES-Bus serial port for connection to most automation systems.
- Easily expandable for more routers and control interfaces.
- Virtually unlimited router sizes, 2048 inputs x 2048 outputs.

Sierra Design Labs uses NVISION HD-SDI at NAB '98

Sierra Design Labs (SDL), a leading manufacturer of video and audio disk recorders, will utilize NVISION routing at NAB. SDL will be demonstrating new compressed and uncompressed HD disk recorders, as well as their existing SDI machines.

At the show, they will use an NVISION universal video router to switch HD-SDI and SDI signals around the booth. This new NVISION router has the unique ability to allow all SDI data rates and 1.5 Gigabit HD-SDI to be managed within the same switch.

NVISION will also provide a 1.5 Gigabit fiber optic link between the SDL booth and their own (both located at the Sands). ■

Minimum switch size	8 x 8
Input expansion increment	8
Output expansion increment	8 (x2)
I/O options	SDI input module HD 1.5 Gbit input module SDI output module HD 1.5 Gbit output module
Control System Compatibility	NVISION NVISION ENVY Tektronix SMS7000 Philips BTS ES Bus Pesa Utah Scientific

EN6064 EN6256 EN6128

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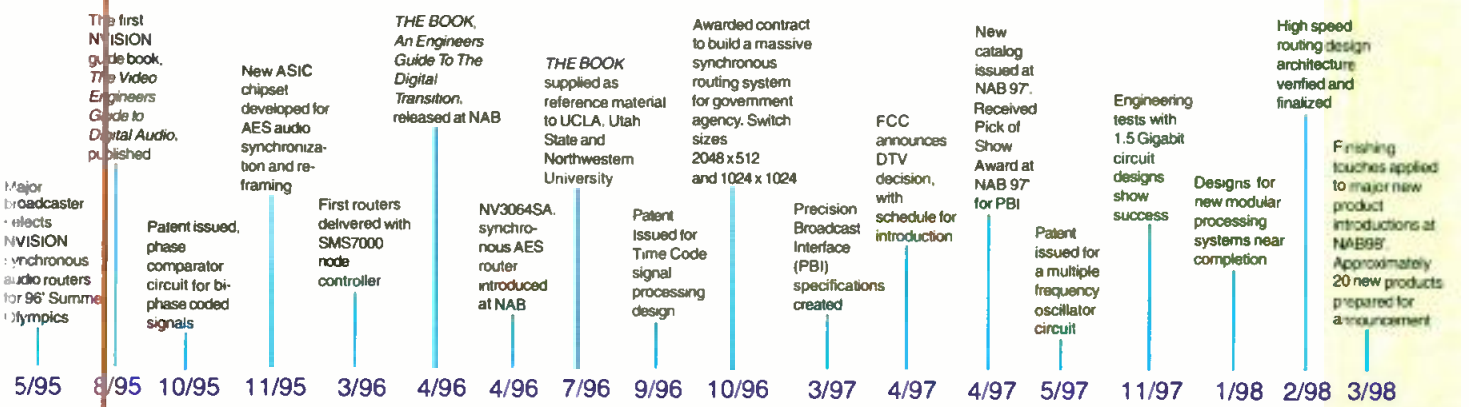

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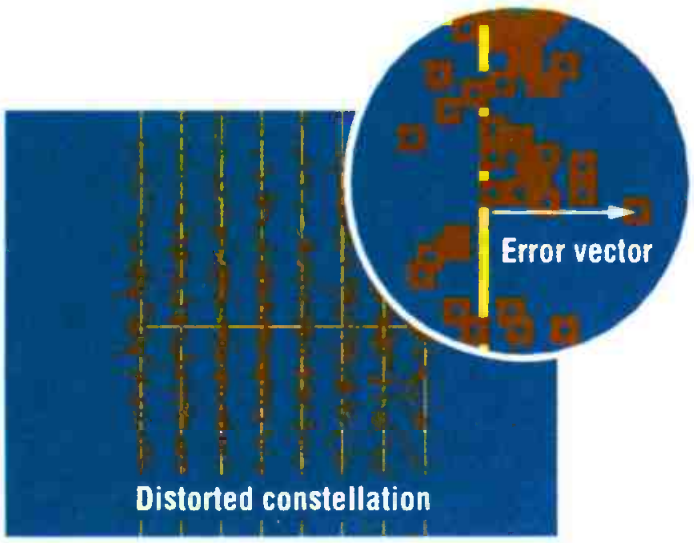

Figure 3. Error vector magnitude (EVM) is the average deviation between the ideal position of a symbol in the I/Q plane and its actual position after amplification.

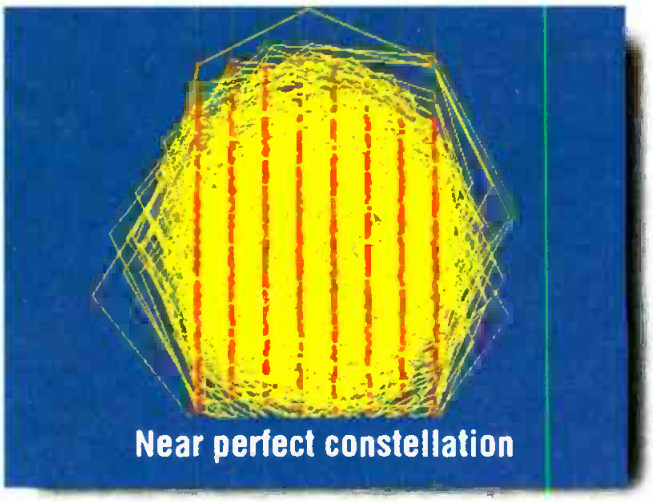

Figure 4. A near-perfect constellation is shown above. A key to this performance is good linearity in the transmitter's amplifier.

ly in the current series of tests to provide a basis for comparison.

Error vector magnitude (EVM) indicates the mean deviation between the ideal position of a symbol in the I/Q plane and its actual position after amplification (see Figure 3). A near perfect constellation is shown in Figure 4.

The signal-to-noise ratio (SNR) is calculated directly from the EVM measurement because the only source of noise in this type of measurement is the amplifier's non-linearity.

Circuit requirements

To correct for non-linearity, it's usually necessary to use correction. However, the use of a pre-correction signal enlarges the bandwidth of the signal at the input to the final stage. Typical input circuits rely on an impedance adapter such as a slug or stub at the circuit's input, shown in Figure 5. The effect is to reduce the passband by generating fast phase rotations. Unfortunately, this makes the correction process less effective. Another approach, developed by TTE for tubes such as the tetrode, Diacrode and IOT, uses a structure with wideband galvanic coupling at the 50Ω point in the input cavity (Figure 6). This design, although already particularly well suited to analog operation, is even more appropriate for digital signals.

In designing cavities for its latest-generation tubes (IOT, Diacrode), TTE drew on its long experience with tetrodes to eliminate all metallic parts with floating potential. The output cavities on the IOTs are therefore coupled by a metallic strip at ground potential, which eliminates random trips caused by RF arcing.

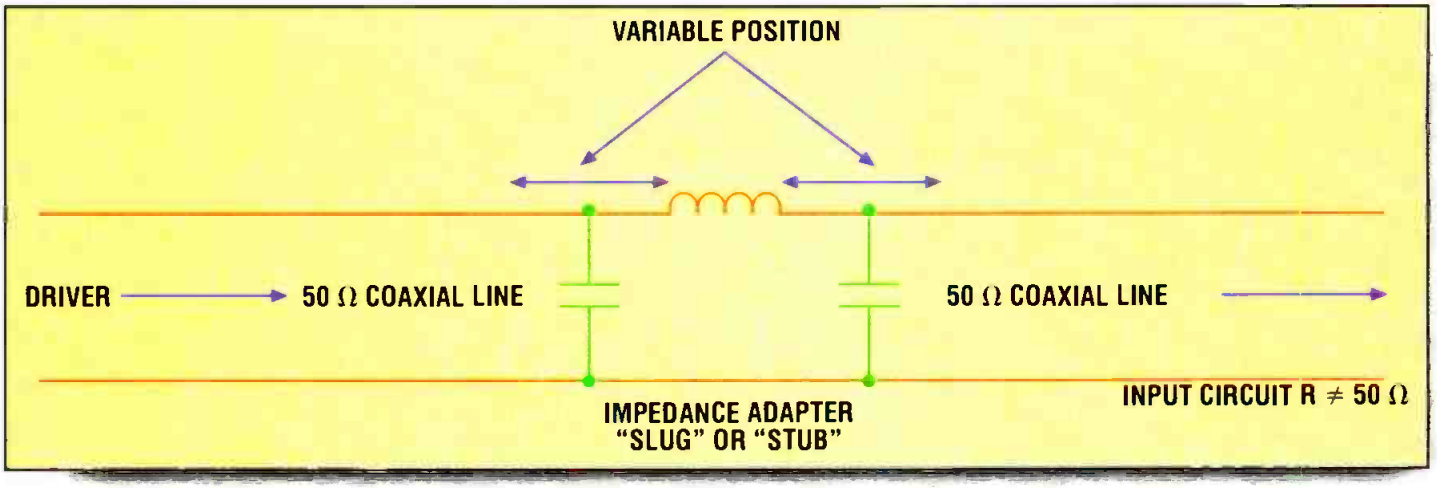

Figure 5. Typical tube input circuits rely on an impedance adapter such as a slug or stub at the circuit's input. Although this helps match the impedance, it also reduces the circuit's passband.

PARAMETER	ANALOG SIGNALS	DIGITAL SIGNALS
LINEARITY	INTERMODULATION PRODUCTS	SHOULDER HEIGHT (SEE FIG. 2)
	DIFFERENTIAL PHASE	EVM (ERROR VECTOR MAGNITUDE)
	DIFFERENTIAL GAIN	
	LUMINANCE NON-LINEARITY	SNR (SIGNAL-TO-NOISE RATIO)
CORRECTABLE PEAK POWER	COMPRESSION	PEAK/AVERAGE POWER RATIO
	CROSS-MODULATION	

Table 1. Comparison between typical analog signal parameters against similar digital signal parameters. The measurements that an engineer would make on an analog signal are not applicable with DTV transmissions. This difference requires a new "mind set" when it comes to evaluating DTV transmitter performance.

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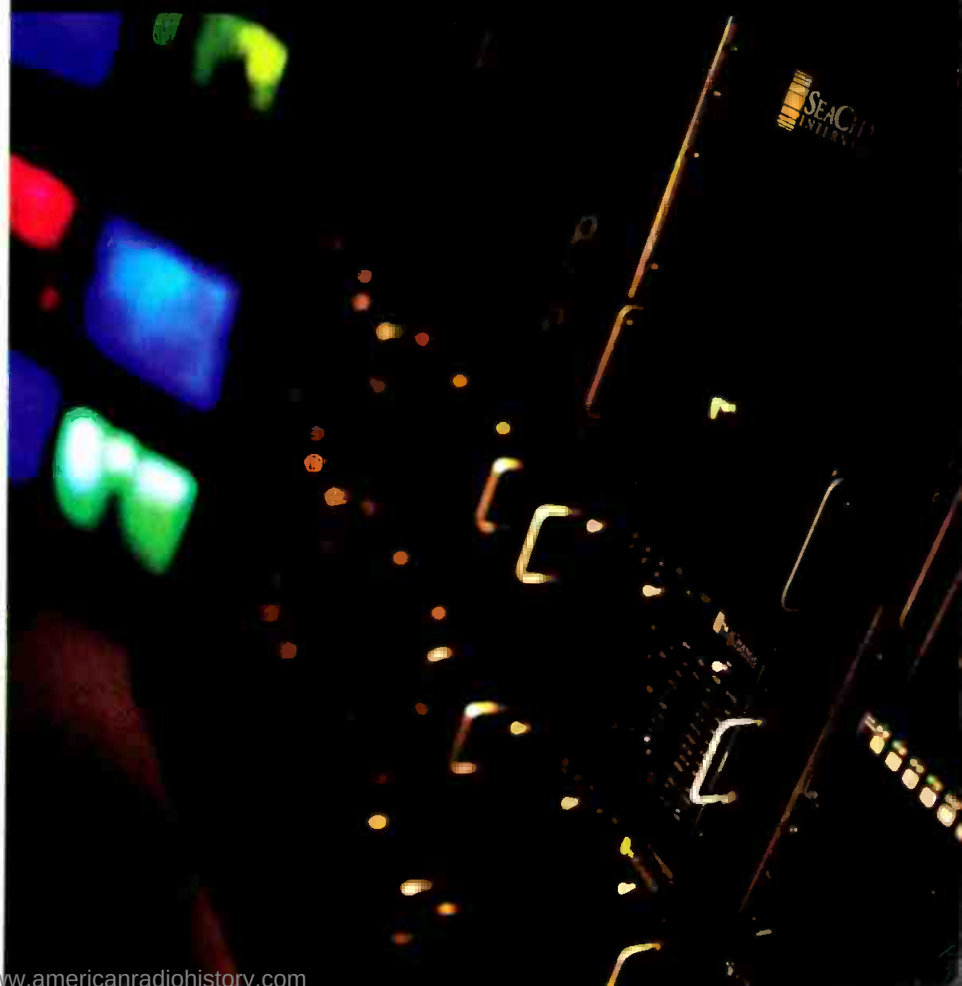

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A test rig for 8VSB digital signal measurements

To determine the DTV power capabilities of various tubes, TTE developed a dedicated test rig. This system comprises a signal generator, which generates random, modulated 8VSB signals at an intermediate frequency, transposed onto the selected channel (for instance, Channel 61 at 755MHz). The signal is amplified by a solid-state stage, operating well under its saturation power level, followed by a tube-type pre-amp stage. The amplification chain was specifically designed to ensure minimum distortion at signal input to the final stage.

The resulting signals can be analyzed at all amplification stages by a vector signal analyzer built into the modulator. The output signal shows the shoulder heights (shown by the markers in Figure 2). After demodulation, the constellation in the I/Q plane can be displayed and three key parameters calculated: error vector magnitude (EVM), signal-to-noise ratio (SNR) and peak/average power ratio.

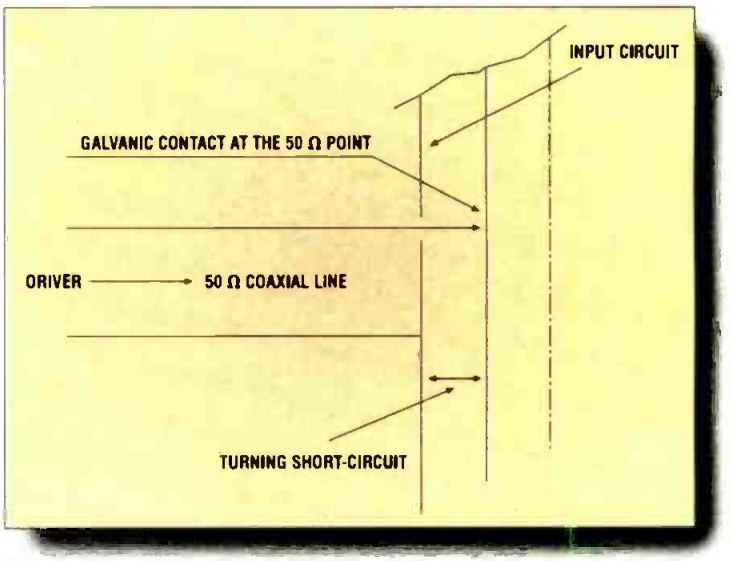

Figure 6. Tubes such as the tetrode, Diacrode and IOT rely on a wideband galvanic coupling at the 50Ω point in the input cavity.

By simply changing the type of final amplifier component in the final stage, it's possible to easily measure the digital performance of tetrodes, Diacrodes and IOTs.

Uncorrected measurements

The first series of measurements was designed to assess tube performance without correction for tube non-linearity. The power readings for certain tubes (see Table 2) show that correction is not always needed on the final stage. With appropriate correction, however, tubes such as the TH 563 tetrode and the TH 680 Diacrode can either deliver more power or provide higher efficiency at a given power level with the same signal quality. The power output of the air-cooled TH 610 Diacrode is limited for digital applications solely because of anode dissipation, not because of inadequate linearity.

IOT measurements have been carried out with shoulder levels 5 to 8dB less than the mandatory 35dB shoulder height, which will be easily attained with the corrections in the transmitter. The results of these tests, even without correction, show that Thomson Tubes Electroniques' line of tubes already covers all digital power requirements.

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TUBE P/N	TUBE TYPE	NTSC PEAK POWER* (kW)	COOLING	HIGH VOLTAGE (kV)	SCREEN GRID VOLTAGE (V)	ANODE CURRENT IAo AND IA (A)	AVERAGE DTV POWER (kW)	SHOULDER LEVEL (dB)	E.V.M.	SNR (dB)
TH 563	TETRODE	30	DEIONIZED WATER	9	900	2.5 / 5	10	35.5	1.63	35.7
TH 610	DIACRODE	10	AIR	6	700	1.2 / 3.2	5.5	35	1.95	33.9
TH 680	DIACRODE	60	DEIONIZED WATER	8,5	800	3 / 8.4	22	32	2.46	32
TH 760	IOT	40	WATER	32	-	0.7 / 1.82	19	30	3.25	29.2
TH 770	IOT	60	WATER	34	-	0.7 / 1.85 0.7 / 2.1	20 25	30 27	2.9 3.99	30.2 27.4

Table 2. Performance characteristics for three types of TTE tubes when operated in the "uncorrected" mode. Note that some tubes don't require correction for DTV operation. However, with appropriate correction, the TH 563 tetrode and the TH 680 Diacrode can deliver more power or provide higher efficiency at a given power level with the same signal quality.

Adjacent channel operation: Advantages of the Diacrode

During the transition period, which could be many years, stations will have to maintain both analog and digital transmitters. There are advantages in being able to transmit both signals with a single device.

The TH 680 Diacrode makes it possible for a single transmitter to simultaneously amplify the two signals when they are in two adjacent channels, i.e., N/N-1 or N/N+1. The Diacrode's naturally low input and output impedance give it a bandwidth exceeding 12 MHz throughout the UHF band. Figure 7 illustrates the respective input and output signals in an N/N+1 configuration.

Table 3 shows the values obtained (without correction) for a Diacrode operating near 750MHz in the N/N+1 configuration. Note the Diacrode's linear performance characteristics. Measured power levels were 25kW peak of sync in analog and 3.3kW average in digital, with easy-to-correct signal quality at the output.

As with other tubes, the transmitted power can be increased by using tubes in parallel. For instance, a transmitter using two Diacrodes will simultaneously deliver 50 kW peak of sync in analog and over 6kW on an adjacent channel for DTV. The power mix may also change over time. In the long run, the analog channel will be eliminated, giving a digital power rating greater than 50kW. Diacrodes used in this way provide an elegant solution to the problems raised by adjacent channel operation.

The impact of digital technology on tube performance

By their very nature, digital signals

Take a Look
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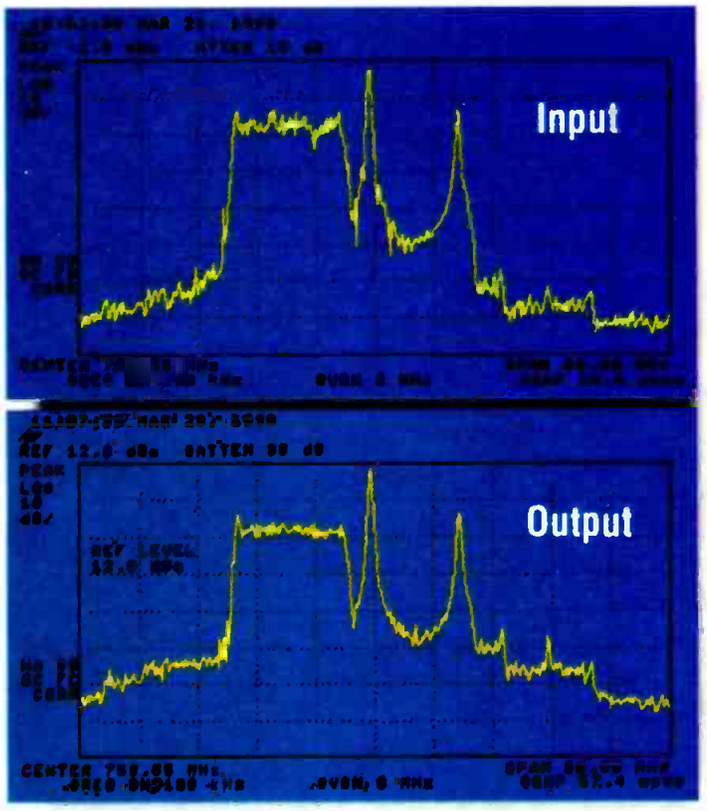

Figure 7. The Diacrode's wide bandwidth, typically exceeding 12MHz, results in highly linear operation throughout the UHF band. The figures above illustrate the respective input and output signals in an N/N+1 configuration.

DTV		ADJACENT CHANNELS DTV + NTSC		NTSC	
AVERAGE POWER	22 kW	3 kW	25 kW	60 kW	PEAK POWER PEAK-OF-SYNC
SHOULDERS	-32 dB	-32.5 dB	-13 dB	-10 dB	SOUND
EVM	2.46%	2.4%	5.2%	10%	DIFFERENTIAL GAIN
SNR	32 dB	32 dB	1.3°	2°	DIFFERENTIAL PHASE
			5.4%	10%	LUMINANCE NON-LINEARITY

Table 3. Even when operated in a non-corrected mode, this Diacrode, operating in an N/+1 configuration, shows extremely linear performance. Measured powers were 3.3kW for DTV and 25kW for NTSC.

impact tube performance. Digital signals are characterized by constant average power and very short power peaks. This in turn means that a high-voltage power supply with high internal resistance can be used without causing untoward effects, which are found in analog service. This allows low-value capacitor filtering to be used in DTV power supplies. An additional benefit is that by decreasing the stored energy, simplified protection devices are possible.

When used for digital broadcasting, electron tubes provide constant power, which means lower thermal and mechanical stress during transmitter operation. Thermal and mechanical stress will only occur during transmitter startup and shutdown. These operating conditions contribute to higher transmitter reliability and longer tube life (30% increase can be expected).

The future

This work, which focused on developing high-linearity components for use in DTV, coupled with measurements of non-corrected 8VSB signals, provides data that can be used directly by both equipment manufacturers and broadcasters. The results show that Thomson Tubes Electronique's Diacrode and IOT solutions provide a complete range of tubes that are perfectly suited to digital broadcasting at average DTV power ratings from 1kW to 30kW.

Over the next few months, tests will continue and TTE will be recording measurements of corrected DTV signals. This will provide additional data on the power capabilities of these tubes for DTV transmitters. ■

Guy Clerc is technical manager at Thomson Tubes Electroniques, and Michel Langlois is digital applications manager for Thomson Tubes Electroniques, Meudon-LaForet Cedex, France.

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Step-by-step approach to HD

BY BOB PANK

The TV industry is faced with momentous change in making the move from the current 525/60 NTSC analog to digital services, which include high definition. Two of the greatest questions this change has presented are what picture format to use and when to implement HD. Today, some of those questions are answered as the leading networks announced their intentions for the initial services, but it is clear that both standard definition (SDTV) and HDTV will operate side-by-side for many years. With the uptake of HD by viewers as yet unknown, making the best use of production and post-production equipment requires special attention.

As facilities move to DTV, the importance of interconnectivity will increase. Shown here is the Quantel Cachebox distribution server, which is DTV and 16:9 ready.

Recognizing the situation, Quantel has devised a scheme to allow the industry to balance real-world economics with the need to change to HD as it unfolds. This is based on the use of existing equipment technology, as well as on two new developments. This step-by-step approach is designed to allow a migration to HD that can go at any pace and make full use of all equipment all of the time.

Step 1: 16:9, 601

The first step, see Figure 1, has already been taken by many broadcasters and post houses using equipment operating with ITU-R 601 4:2:2 component digital coding. Any equipment delivered by Quantel in the last three years is already one step toward the new TV formats. At the tap of a menu box, operation is switched between the 4:3 aspect ratio used today and the 16:9 called for in many of the ATSC's Table 3 video formats. This scheme enables operation with 16:9 video; to see the correct picture, monitors must be set for the new aspect ratio. The signal is essentially no different in nature but is shot and displayed on a wider screen. Changes in the geometry of areas such as DVEs, graphics, text fonts, paint brushes and wipes are implemented to maintain their correct aspect ratio in the wider display.

Step 2: Up-rez

Pictures produced via the 601 chain represent the highest quality of current television, but this quality is rarely seen because many factors can affect the result. In many instances image sources such as video may not fully exploit 601's potential to deliver sharp, clear pictures. The use of digital compression may limit frequency response or impose blocking effects, and the analog compression of NTSC coding imposes further bandwidth limits, especially in the chroma. No wonder that many who see 601 studio pictures for the first time are so impressed that they think they are already looking at HDTV.

The full potential of 601 currently is best seen from well-shot and well-telecined 35mm film. The film is effectively an oversampled source and produces the sharpest 601 images. When these images are post-produced via a non-compressed 601 chain, the results are excellent — way beyond run-of-the-mill NTSC. The introduction of DTV, with its 480- through 1080-line resolutions, replaces NTSC compression with MPEG-2. Anyone looking at well-produced DVD movie titles (and avoiding the NTSC connection) can already see the excellent quality that MPEG-2 can deliver at modest bit-rates.

Work done back in 1991 with Quantel's HD Paintbox proved the value of good 601 images as sources that could be up-rezed to HD (1,000+ lines) with pleasing results. More recently, images shot on 35mm film, post-produced on 601 equipment, up-rezed to 3,000x2,000 and output back to 35mm film via Quantel's Domino have been widely shown in cinemas, where they stand up well against other pure film

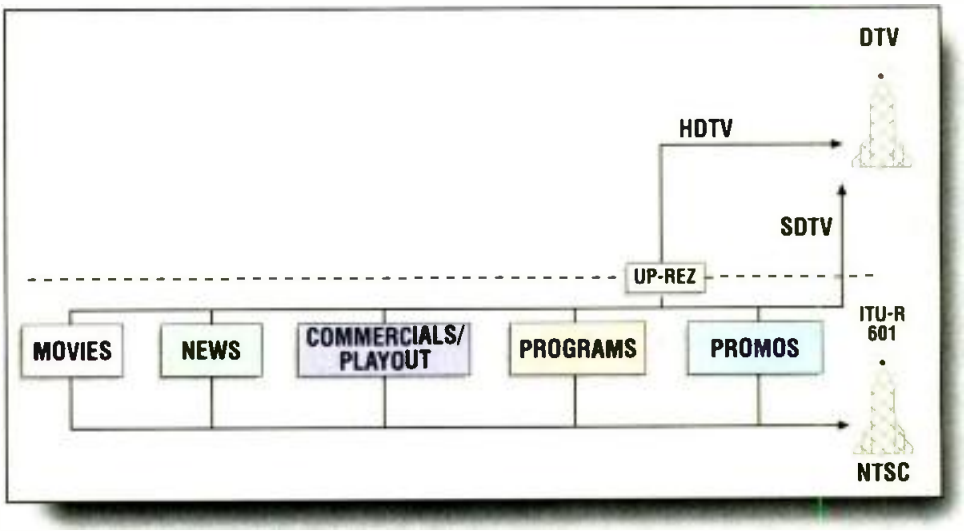

Figure 1. Simulcast where all production is carried out in 601.

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HD applications will increase the need for graphics (and interconnection) functionality. The Paintbox F.A.T. provides both HD and 16:9 feature sets to users.

material.

This example fully validates the next step to HD: up-rez well-produced 601 material to HD (see Figure 2). At NAB this year, Quantel showed results from up-rez at 1080p. The up-rez involves making the best possible use of all the original material. Multipoint bi-cubic interpolation, already applied in print and film resolution systems, was used. Because this process involves vast numbers of calculations to produce high-quality HD images, dedicated hardware is used to give real-time results.

Step 3: Network

During the transition to HD, signals from both normal and high definition will be used to make up programs for both standards. To streamline that process, Quantel has announced that it will introduce a network for video and audio: Clipnet.

To provide infrastructure not only for today's television, but also for HD, Clipnet is standards-independent. And to embrace a broad range of equipment beyond Quantel, it will also connect with computers and other TV equipment. For speed, it must provide a transfer rate at least as fast as ITU-R 601 data: 270Mb/s. Current favored technologies are Fibre Channel and Gigabit Ethernet, and the final choice will be based on performance, cost and industry preference. Although Fibre Channel was used at NAB, no decision is expected until the fall. (Quantel is interested in hearing the views and opinions of its users on this matter.)

Clipnet will lead to a series of new developments. These developments will take full advantage of the growing body of disk-based equipment used to create new topologies honed to suit new needs and styles of operation. Because this development applies to both today's TV standards and tomorrow's HD, it allows broadcasters and post houses to take early advantage of the technology knowing that it will continue to fit with their future plans.

Clipnet will complement Picturenet (Open), the 100Mb/s Ethernet network for stills and graphics that is already in use. As with Picturenet, Clipnet on Quantel equipment will operate as a totally background task so that all normal operation is fully protected and not interrupted. This point is important for post houses and vital for broadcasters, where on-air or near-to-air operations must continue at all times. Because of the large bandwidth available from the disk systems in Quantel equipment, high network transfer rates can be sustained even while the equipment is fully operational.

Clipnet will provide transport for a wide variety of signals. Besides operating with full 601 and HD, Quantel equipment also uses DV compression at 25 and 50Mb/s. It is expected that DV25 data will transfer at up to 10 times real-time.

Combining Clipnet with Step 2 allows an up-rez node to be available to any system on the network. Thus, any video produced on any connected machines can be used in HD operations, which allows a station to adopt a soft approach to HD. It can be on-air with HD, yet not be required to commit large sections of capital to a whole raft of HD-native equipment. As HD expands and more HD-native equipment supplies the area directly, the demands on the 601 equipment and the up-rez function can be adapted.

Demands could also develop in the other direction. This HD-original material can be down-rezed to supply the 601 area, thus avoiding the need to duplicate effort and providing outstanding images for 525 viewers.

Step 4: The Full Monty

The final step introduces equipment working directly at HD resolution (see Figure 3). The demonstration at NAB of "The Full Monty" was a technical statement that achieving the largest format of the ATSC digital standard, 1080p (shown running at 60Hz rather than 30Hz to reduce flicker on the monitors) is well within Quantel's reach. This fact should be no surprise to those involved with film compositing because the Domino film compositor has been operating at up to 3k x 2k for five years and providing real-time replays.

Monty is a preview of a new technology platform designed for HD. As the

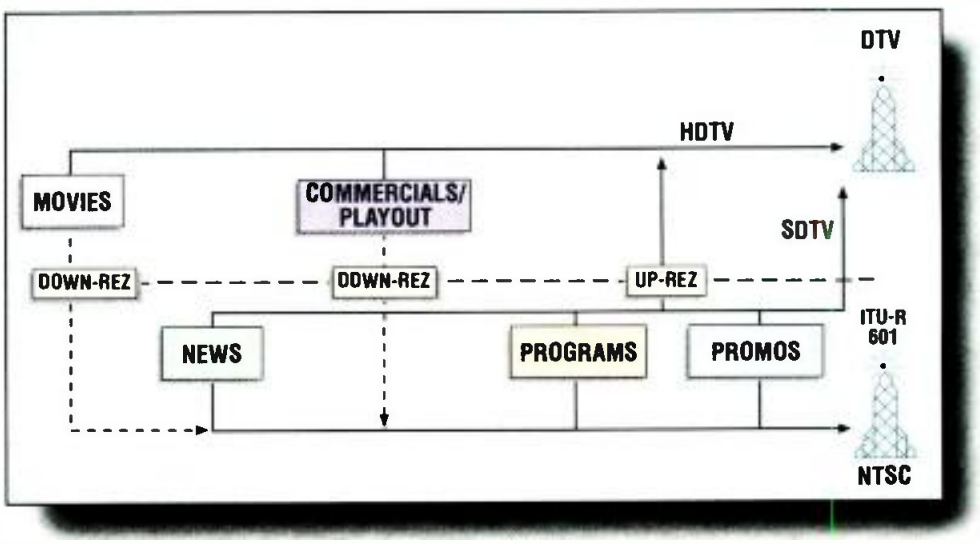

Figure 2. Hybrid production mixing down-rezed native HD and up-rezed 601.

ATSC defines a number of different production formats, it is essential that any equipment should be able to work with any one of them. It is also clear that material will be generated and made available in any of them. To make full use of this versatility, Monty can accept and operate with any TV format, plus normal 525/60, and output as the same or any other format. More than that, it can compose video from any TV source onto one picture — true resolution independence. Thus, the wealth of 525 source material can still be used either as elements for composition or at full-screen. If material for a documentary were available on 16mm film, 525/60 D-1, 525/60 Beta SP, 1080i, 720p and 480p, it could all be used directly.

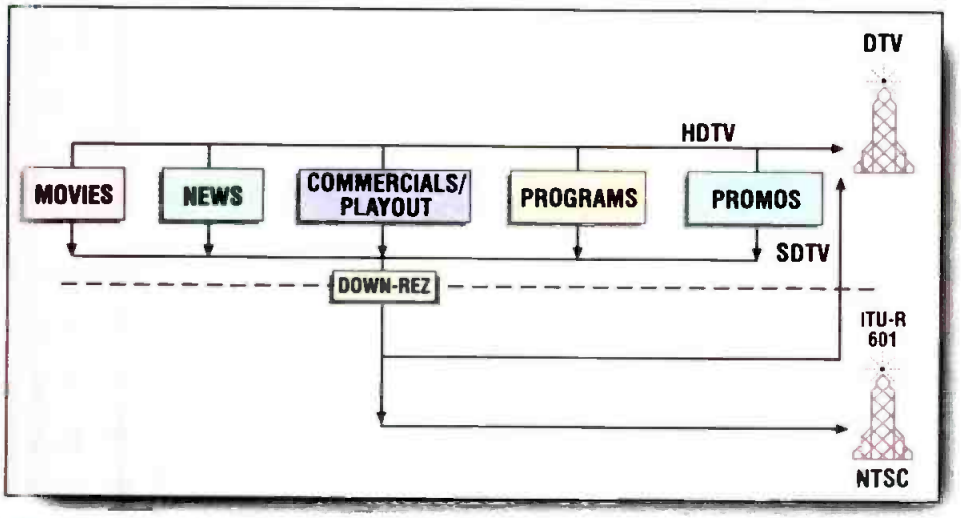

Figure 3. A full HD-production environment with downconversion for SDTV and NTSC.

The idea of Monty is to build a system to handle the largest format from Table 3 (1080x1920) with the same speed and flexibility that program makers are already accustomed to with normal resolution Quantel equipment. This way every format is handled fast, maintaining both the creative flow and everything that makes the medium as fast and flexible as it is today.

HD will have a major impact on the broadcast business. Quantel's step-by-step approach aims to make HD practical and creative for all involved with editing, post production and graphics. HD cannot signal the return to outdated production methods or limit operational flexibility. Neither can it obsolete all of today's facilities. Quantel's step-by-step addresses these concerns with a pragmatic approach that balances short-term issues against long-term aims. ■

Bob Pank is technical communications manager, Quantel Ltd., Newbury, UK.

Upconversion and digital television

BY ADOLFO RODRIGUEZ

The arrival of digital television (DTV) in the United States has brought high-definition video to the top of the list for many video facilities. One of the many challenges DTV brings is the availability of high-definition program material in the early years. This is where upconversion plays an important role by providing high-definition video from the standard-definition programming available today. Upconversion is also a critical component in any video facility in the long term.

What is upconversion?

Upconversion converts standard 525-line or 625-line video to high-definition line rates. The DTV standard has different high-definition line rates, as illustrated in Table 1. Upconversion can also include conversion of the aspect ratio from 4:3 to 16:9.

Format	Horizontal Pixels	Vertical Lines	Picture Rates
1080	1920	1080	60i, 30p, 24p
720	1280	720	60p, 30p, 24p

Table 1. The DTV standard provides several options for broadcasters' transmitted image standards.

There are several methods used for upconversion, but they all generally include the creation of new pixels to reach the high-resolution line rates. One approach is to use line doubling or line quadrupling technology to get close to the required number of active lines (1080 or 720 in the case of DTV). This line multiplication approach is then combined with a scaling function to obtain the exact number of active lines. For example, to create 1080 interlaced active lines, the active portion of the 525-line video (483 lines) may be de-interlaced, and lines may be repeated as vertically adjacent pairs and then scaled to achieve 1080 active lines, which are re-interlaced. This approach achieves the higher line rates but with compromises. The line repetition may lead to the cascading of artifacts as the video signal is doubled or quadrupled.

A better approach is interpolation technology to achieve the higher number of lines and higher number of horizontal pixels. Horizontal interpolation is used to get from 720 pixels to 1280 or 1920 horizontal pixels. Vertical interpolation is used to get from 483 active lines to 720 or 1080 active lines. Interpolation technology provides the highest accuracy upconversion by using both spatial and temporal information. This spatial-temporal filtering process creates new picture information rather than simply repeating the information already within the video signal, resulting in greater picture resolution.

How good does upconversion look?

Most people are surprised when they first experience the quality of an upconverted high-definition signal. The expectation is generally that it cannot possibly look as good as a true high-definition signal available from full high-definition production. However, upconversion using interpolation technology delivers an enhanced viewing experience by providing a higher horizontal resolution, a higher line rate, the benefits of component digital video and a 16:9 aspect ratio. It also releases about 40% of the vertical resolution present in the standard-definition signal but not seen in an interlaced display because of the Kell factor effect.

The Kell factor defines the effective vertical resolution perceived by the human visual system when viewing an interlaced video display. A typical Kell factor is 0.7, which, applied to the 525-line system, results in an effective vertical resolution of 338 out of 483 active lines. Using interpolation technology, the resolution of all 483 lines can be used to generate the higher line rate of 1080 or

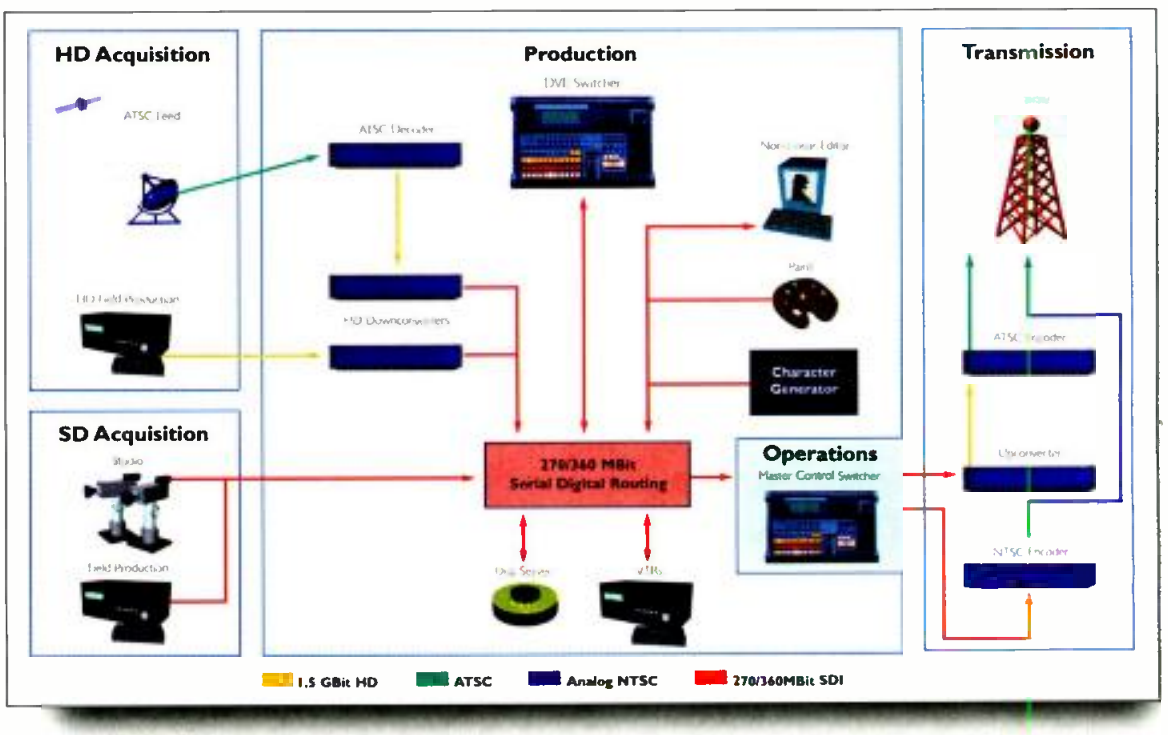

Figure 1. The 601 option affords stations a cost-effective entry point into DTV, while laying the needed digital foundation for future HD origination.

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720 active lines. This additional 40% of vertical resolution ((483-338)/338 ~40%) provides more resolution to interpolate, which contributes to the enhanced HDTV viewing experience.

Applications of upconversion

In many cases, upconversion can reduce the transition cost to DTV by allowing facilities to leverage off their vast quantities of archived 525-line material. This gives broadcasters the flexibility to start transmitting HDTV immediately by using current infrastructure. For example, a facility would use downconversion to standard definition, add lo-

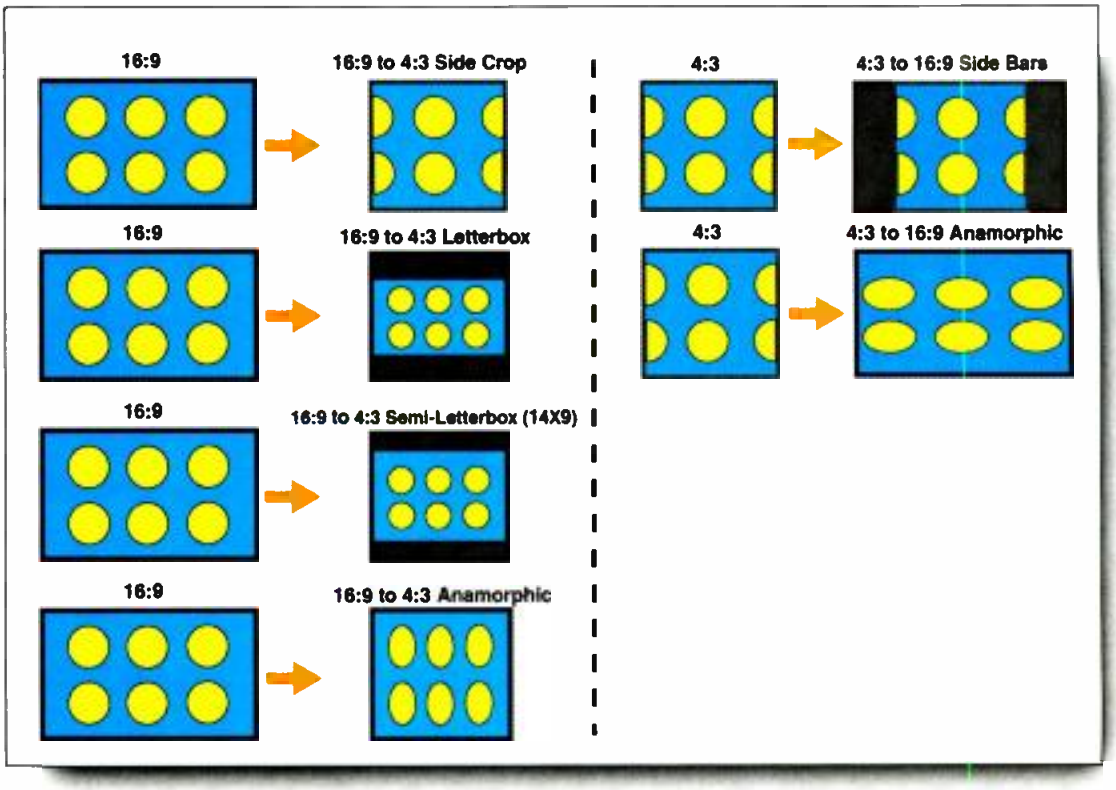

Figure 2. When converting from 16:9 and back, a range of options exists. Engineers need to be sure that the equipment selected to handle this task is capable of artistic decisions that may come from the programming staff.

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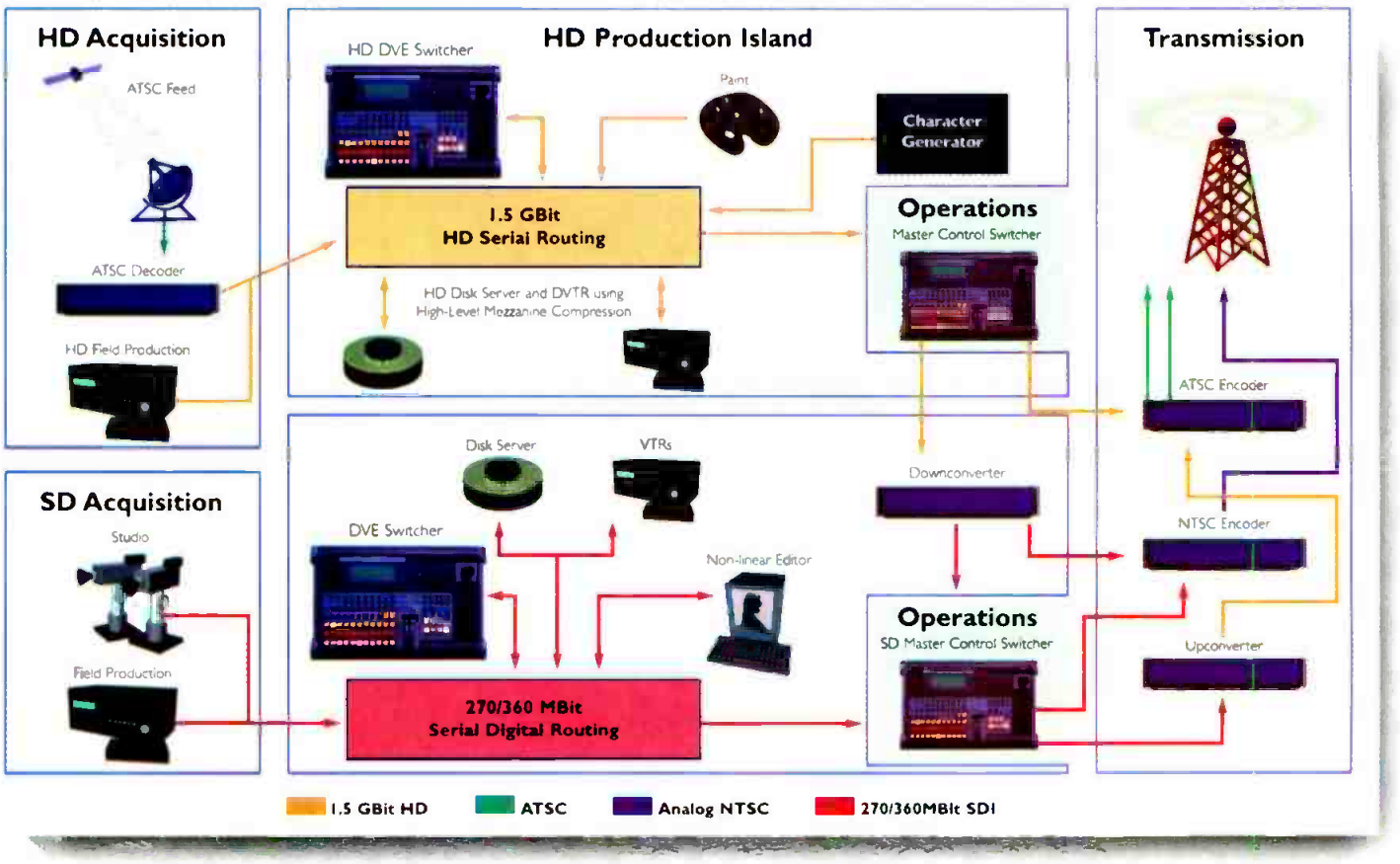


Figure 3. This HD production island approach affords stations a cost-effective way to begin HD transmissions without having to completely rebuild the facility. Legacy equipment, supplemented with up- and downconversion equipment, can greatly reduce the entry cost of beginning HD broadcasts.

cal production and identification, up-convert, then simulcast high-definition and standard definition.

Optimizing upconversion

An up-converter is like a magnifying glass, and any artifact present will be more visible when converted to high definition. Because upconversion quality is limited to the resolution and quality of the original material, care must be taken when up-converting to high definition. The best upconversion results are obtained by using analog or digital component 4:2:2 signal sources. The use of 4:2:0 or 4:1:1 sampling structure should be avoided if possible because they can reduce chrominance resolution for use in the interpolation process.

When up-converting from composite (NTSC, PAL, PAL-M or PAL-N), it's important to use a high-quality decoder. The best decoding performance is obtained from an adaptive three-dimen-

sional decoder, such as the Snell & Wilcox Golden Gate. Again, the objective is to reduce any decoding artifacts, such as cross-chrominance or cross-luminance, before up-converting. Once these types of artifacts are introduced, they are difficult to remove in a downstream process and will be obvious in the up-converted high-definition video.

Noise is another critical quality consideration when up-converting standard-definition video. Noise is present in all signals and can come from many sources. Many types of video noise are inherent in the video processing or distribution methods employed in TV stations. Video noise can be caused by the electronic processing in a transmission system, crosstalk, dropout, time-base errors in VTRs, and digital errors in digital links. As with decoding artifacts, noise is magnified by the upconversion process, which produces a less than optimal high-definition signal. It is therefore important to reduce this noise before the upconversion process.

This is where a noise reducer plays a vital role in eliminating as much of the noise as possible before converting the video to high definition. Noise reducers usually provide a number of video filters tuned to reduce a particular type of noise. Typical choices include recursive filters, which reduce noise by filtering the video temporally; spatial filters, which filter the video in the spatial domain; non-linear median filters, which remove impulse noise; and linear filters, which remove high-frequency noise.

The best upconversion results require great care in decoding composite video sources and always use noise reduction techniques before upconversion.

Aspect ratio

Not all upconversion and downconversion decisions are quality related. Besides a higher horizontal and vertical resolution, high-definition video also has a different aspect ratio than we are used to seeing in television today. This difference requires some creative production decisions to be made with respect to the viewable area. Using proper filtering, an up-converter or down-converter can pan, scan, re-size, or re-shape the image. For example, converting from 16:9 to 4:3 aspect ratio, the image can be cropped and put in letterbox or semi letterbox. Conversely, when converting from 4:3 to 16:9 format, the image can be displayed with sidebars or semi sidebars, or it can be anamorphically stretched to fit the new format. Figure 2 summarizes these options.

Upconversion in the long term

The goal of most video facilities is to move to high-definition video production as soon as possible, but to do so in the most cost-effective way. One such method is to design high-definition islands. This approach is illustrated in Figure 3. This design uses an existing video infrastructure equipped with small islands of HDTV production. This method minimizes the initial investment and provides a cost-effective way to build toward full HD capability. The role of upconversion in this scenario is to provide a way to use the large amount of standard-definition archive material most facilities have — and need to use. An added benefit is combining upconversion with standard-definition cameras for close-up shots in sports and insertion of standard-definition news clips.

A good solution

Upconversion can be a great asset for any facility moving to high-definition video production. In the short term, upconversion (and downconversion) will help get HD signals on the air while high-definition-generated program material grows. Over the long term, upconversion provides a way to deliver quality standard-definition archive material in a high-definition environment. In addition, upconversion also provides some interesting video production options by providing a way to use standard-definition video in special cases, such as close-ups in sports and news acquisition. ■

Adolfo Rodriguez is director of marketing, U.S, Snell & Wilcox, Sunnyvale, CA.

Video servers

BY THE BE STAFF

The use of video servers is ubiquitous. No matter how small the facility, TV station or production house, servers are now key to an efficient operation. However, just because they are common, doesn't mean they're easy to buy — or to understand. Video servers have their own terminology, and the first step in buying any server is to understand the language.

Video server terminology

• **Primary application:** Many manufactures will claim that their servers will do everything. It's a news server, a production DDR and an on-air playback server. Don't believe it. While the basic building block may be able to do all of these things, the surrounding systems tailor the server to a task.

For instance, the features of a news server are vastly different than those of a DDR application in a post suite. In one case, you need to handle multiple users, probably with minimal quality. On the other hand, production applications typically serve only one or two clients and do so on a few I/O paths, but perhaps need HD quality.

All this doesn't mean one company's product won't work in a variety of applications. It does mean that the product needs to be configured differently for every type of application. Check and be sure that's possible.

• **Number of I/O channels supported simultaneously:** Like above, be sure the system is tailored to the number of channels you need to serve. This operational feature is highly related to maximum aggregate bandwidth and number of workstations.

• **Number of workstations supported:** How many clients (workstations) do you need to serve. An on-air server has one or two workstations; a news server may have 20 or 30. Determine the quality level that is needed at each location.

• **Maximum aggregate bandwidth:** It's a lot like dividing a pie; the server's total aggregate bandwidth is a resource that must be divided among its inputs and outputs. For instance, a server bandwidth of 250Mb/s might allow you to handle one video input and four compressed video outputs, but it won't provide dual streams of HD video.

• **Compression encoding:** Motion JPEG used to be the most common compression format. However, as of this year's NAB, most server vendors began offering MPEG encoding with their systems. This allows stations to limit the number of encode/decode processes.

Finally, some servers provide uncompressed recording. This works only for short-format applications. It takes 121GB per hour of video. Try storing 1,000 commercials in an uncompressed format and see how much it costs. However, if you're producing those commercials, you may want to keep all that layering in uncompressed states until the final product is produced; but that may be minutes — not hours — of storage.

• **Range of compression:** Naturally, this relates to the amount of compression used. A 1:1 ratio would be uncompressed, where as 4:1 might be considered a mildly compressed signal. In PPV and NVOD applications, 20-30:1 compression levels are common. That works here because the video is never manipulated. It's designed only to be viewed.

• **Output signal interfaces:** Early servers stuck to 601 or NTSC outputs. Today, many offer ATM and Fibre Channel (FC). First, ask what's needed now, then ask whether you'll need to support other types of outputs in your DTV future. Many vendors are offering optional ATM outputs.

• **Support random access:** True random access does not mean playing a clip from one location and the next clip from the next sequentially-stored location. It means playing any clip from any location at any time. The location of the clip is independent from whether or not it can be played sequentially. Production applications often require this feature.

• **Smallest randomly-accessed clip:** What is the smallest clip that can be played indefinitely? Check this specification carefully. It depends upon the speed of the disk and the amount of onboard memory. In post and editing applications, this is important.

• **Support pre-read:** Only now are server vendors realizing that editors need the ability to handle pre-read. In essence, they're asking the server to "act" like a tape machine. On-air and news servers may not need this feature. Production environments certainly would see this feature as useful.

• **Non-destructive pre-read:** While tape pre-read is destructive, disk pre-read doesn't have to be. The implementation of this feature depends on the vendor.

• **Automation traffic interfaces:** Simply put, most on-air servers will interface to most traffic systems. If you are planning on adding a server into an existing cart machine environment, be sure the vendor will help you with the interfacing.

• **Backup/redundancy:** How much do you want? How much are you willing to pay for? Although disk systems are reliable, they are not infallible. Do you need mirrored systems, dual power supplies, hot-swappable drives? All these are available and only you can decide which are important to your application.

The table

The table on pages 128 and 129 lists key server manufacturers and their products. The goal was to provide, in one compact table, a sampling of server products that are available. Coupled with your set of needs and an understanding of key terms, you're ready to decide which products to consider further. ■

Windows to the Web

www.stortek.com

StorageTek: StorageTek's MediaVault is a complete storage management system for broadcasters migrating to digital systems. It combines ultra-fast automated tape libraries, ultra-high capacity SD-3 helical-scan cartridge drives and applications-enabling software.

www.pinnaclesys.com

Pinnacle Systems: Pinnacle Systems' broadcast products give professionals the cutting edge tools needed to create dazzling productions faster and more affordably than ever before. These innovative digital video manipulation tools perform a variety of on-air, production, and post-production functions such as the addition of special effects, image management, capture, storage, and play-out, as well as graphics and title creation.

www.e-trim.com

eidria: e-trim is the logging and machine control package for the 3Com PalmPilot and PalmIII series of handheld devices. e-trim provides complete connectivity to most cameras and decks, including RS-422 and LANC (Control-L) devices, as well as LTC timecode feeds - all without any adapters or converters. Simply connect e-trim to your source, mark in and out times to create clips, then HotSync with any Macintosh or Windows computer and your log is ready for import into a variety of editing systems. Questions? www.e-trim.com

www.broadcastengineering.com

Broadcast Engineering: *Broadcast Engineering* is the only technology-driven online magazine in the industry. Its editorial environment delivers practical, informative articles on digital technology, systems integration, management, how-to installation, and systems and equipment maintenance. It is a package geared toward TV stations, cable/telcom, production, post-production, business TV, satellite and interactive television.

www.nova-sys.com

Nova Systems: A leading manufacturer of signal processing equipment for television broadcast, teleproduction, and industrial video applications. Nova's product line corrects, converts, and distributes video as well as audio signals.

Company	Free Information Number	Model	Primary Application	# of I/O channels supported simultaneously	# of workstations supported	Maximum aggregate bandwidth	Compression encoding supported?	Range of compression provided	Support uncompressed HD format signals?	Output signal interfaces supported	# of audio channels and data rates of each?	Support true random access?	Smallest, randomly accessed clip	Support Pre-read for editing?	Destructive-/Non-destructive?	Automation/ traffic interfaces	Backup/ redundancy provided?
Accom Inc	450	Axess	On-air	4 per work station	32 maximum	N/A	Uncom-pressed	N/A	N/A	ITU-R/BT.601 and AES audio	4-track AES, 48kHz	Yes	1 frame	N/A	N/A	Louth, Pro-bel	Zip drive, MO, DLT
ASC	451	VR300	On-air	20/FC-AL, 60/FC Fabric	20/FC-AL, 60/FC Fabric	1Gb/s/FC-AL, 3Gb/s/FC Fabric	M-JPEG 4:2:2	2.3:1 to 30:1	No. It supports mezzanine level HD compression	SDI, composite, analog component, FC, ATM	4 audio ch/video ch, 48kHz AES	Yes	90 frames	No	Non-destructive	All leading systems	RAIDsoft, hot swap drives; dual PS/fans
Avid	452	Media-Server	News	12 video clients and 48 audio/ client	12 clients	60Mb/s	JPEG, M-JPEG	AVR 70 and 70H or 110KB/frame	No	FC/SCSI and ATM	48 channels of audio, 44.1kHz and 48kHz	Yes	1 second edits	N/A	Non-destructive	Avid AirPlay MP/beta carts	RAID-3
Celerity Systems	453	CTL-9000	On-air	600 at 3Mb/s per node, multiple nodes supported	600 w/network, 6000 users/node	1-8Gb/s	MPEG (or any binary format)	9Mb/s MPEG-2 to 1.5Mb/s MPEG-1	No	ATM over OC-3 or ATM-25.6	User selectable from 56Kb/s to 384Kb/s	Yes	A single video frame	N/A	N/A	Celerity's Multimedia Interactive Exchange software	RAID
dataDIRECT Networks	454	CDNA	News	1000	1000	up to 20Gb/s	Uncom-pressed	User selectable	Yes	FC, SCSI (ATM future release)	8 channels	Yes	user selectable	Yes	N/A	yes	
Drastic Tech-nologies	455	VVW series	On air	2, 1x2	24 FC-AL	20Mb/s	M-JPEG	M-JPEG, MPEG-2,DV, DVC, 10-bit	No	FC, SCSI, WideBand, Gb	4 channels	Yes	1 frame	Yes	Yes	OVDR/ Odetics/Louth, RS-422	RAID
Digital Video Systems (DVS)	456	Clip-Server-HD360	Production	4	up to 20	1.5Gb/s	HD360 (Panasonic HD-D5)	4:1	Yes	FC, SCSI, ATM, 292M	4 or 8, 1Mb/s	Yes	1 frame	Yes	Non-destructive	Louth compatible	RAID-3 option
	457	Clip-Serv-er-Pro	Post Production	4	up to 20	1.5Gb/s	Uncom-pressed	None	No	601, FC, SCSI, ATM	4 or 8, 1Mb/s	Yes	1 frame	Yes	Non-destructive	Louth compatible	RAID-3 option
	458	Pronto-Vision-S	On-air	2	up to 20	3Gb/s	Uncom-pressed	None	Yes	292M, FC, ATM	8, 1Mb/s	Yes	1 frame	Yes	Non-destructive	Louth compatible	RAID-3 option
Doremi Labs	459	V1 Server	On-air	24	64	200Mb/s	M-JPEG, MPEG-2 4:2:2	2:1 to 34:1	Yes	FC, SCSI, Ethernet	Up to 8, 48kHz	Yes	1 field	Yes	Non-destructive	Standard Sony 9P, Louth	Tape backup
Hewlett-Packard	460	Media-Stream Broadcast Server	On-air	6	N/A		MPEG-2 4:2:0 and 4:2:2		No	FC, 10Base-T	Up to 4, AES/EBU, 48kHz, 16-bit per video channel	Yes on any IBP frame		N/A	N/A	Abit Ltd, Columbine JDS, Computer Engineering, Drake, Florical, Louth & others	RAID Protection; Redundant PS and fans, rmt diagnostics
	461	Media-Stream Disk Recorder	On-air	5	N/A		MPEG-2 4:2:0 and 4:2:2		No	FC, 10 Base-T	Up to 4, AES/EBU, 48kHz, 16-bit per video channel	Yes on any IBP frame		N/A	N/A	See above	RAID Protection; Redundant PS and fans, rmt diagnostics
Mountain-gate	462	Centra-Vision	Production	Many	Many	Many GB/s	Uncom-pressed	N/A	N/A	FC	2 analog	Yes	1 field	Yes	Destructive	Full TCP/IP support	RAID-1
Pluto Tech-nologies Int'l	463	Video-SPACE	Production	1	Unlimited	100MB/s	Uncom-pressed	1:1	No	FC, SCSI; Serial HPPI to come	4, 48kHz, 24-bit	Yes	Back-to-back frames	To come	Destructive	Louth protocol to come	RAID-3 data protection, hot swappable drives, background rebuilds dual PS

	464	Hyper-SPACE High-Definition	Production	1	Unlimited	100MB/s	DCT	1:1	Future release	FC, SCSI, Serial HPPI to come	4, 48kHz, 24-bit	Yes	Back-to-back frames	Under investigation		Louth protocol, to come	RAID 3, hot swappable drives, background rebuilds, dual PS
	465	AirSPACE Multi-channel	News	10/server, more by linking multiple servers via FC	Unlimited	100MB/s	DV	25 or 50Mb	No	FC, SCSI, Ethernet, 10-bit CCIR601	8 per video channel, 48kHz, 16 or 24-bit	Yes	Back-to-back frames	To come		Any system using Video Disk Control Protocol (VDCP) or Pluto API	RAID-3, hot swappable drives, background rebuilds, dual PS
Quantel Ltd	466	Clipbox	Post Production	Up to 14		8 x uncompressed 601	Uncom-pressed (ITU-R 601) and Grid Compression (M-JPEG based)	Uncompressed and/or 5:1 to 20:1	Yes	SDI (with embedded audio), Network interface pending (Clipnet)	4 audio ch/per port, 48kHz/20-bit sample	Yes	1 video frame	N/A	N/A	Open rmt control interface and integral clip management system	RAID storage, field fmode replay and fully redundant system disk
	467	Cachebox	On-air	4		> 4x50Mb/s	DVCPRO (25Mb/s DVCPRO-50 (50Mb/s)	5:1 (DVCPRO) 3.3:1 (DVCPRO-50)	No	SDI, Network interface pending	DVCPRO: 2ch/port, DVCPRO-50: 4 ch/port, 48kHz	Yes	1 video frame	No	N/A	Open remote control interface and integral clip management system	RAID storage
SeaChange International	468	Broadcast Media-Cluster	On-air	20 I/O per 5-node cluster, scalable to any number of I/O		Up to 4 MPEG-2 codecs at 24Mb/s	MPEG-2, 4:2:2P@ML and 4:2:0 MP@ML, mixable	4Mb/s - 24Mb/s	No	270Mb/s SDI, DVB, Fast and Gigabit Ethernet	2 AES/EBU channels per video I/O	Available early 1999	3 seconds	Editing available early 1999	N/A	Louth VDP, OmniBus protocols supported, w/ manual playback	RAID-5
Sony	469	FlexSys/-MAV-70	On-air	Up to 10	Up to 32 with option software	370Mb/s	MPEG-2	4:2:2P@ML and MP@ML from 1.5 to 50Mb/s	Yes, 1080i & 720p at 4:2:2P@HL and MP@HL up to 60Mb/s	Baseband, MPEG2 bit-stream, Fibre Channel, Ethernet 100BaseT	4 ch for SD, 8 ch for HD at 48kHz uncom-pressed	Yes	2.5 seconds	No	NA	Sony playlist, soon: Louth, Drake, Pro-bel, Florical, Cyradis, MicroFirst	RAID-3 storage, hot swappable PS, fans.
Tektronix	470	Profile	On-air	1x2, 1x6, 2x4, 8 out	8	Approx. 250Mb/s	M-JPEG, MPEG 4:2:2P@ML	MPEG: 4Mb/s, 4:2:0 or 4:2:2; M-JPEG: up to 48Mb/s		Fibre Channel, SCSI, ATM with Profile video gateway	16/32 channels total, max 16 audio ch/video @48kHz	Yes	1 frame	Yes	Non-destructive	Columbine, FloriCal, Louth, Drake, Omnibus, Alamar, KEOPS, Pro-bel, Crispen, others	Mirrored systems, data tape backup
Vela Broadcast	471	Rapid Access	On-air	1x5	Multiple	90Mb/s	MPEG-2	1.5 - 15Mb/s	No	Fibre Channel, SCSI, 10BaseT Ethernet, 100BaseT Ethernet	2 and 4 channels, 48kHz@ 20-bits	Yes	2 seconds	No	N/A	Louth, Sony, 9-pin	RAID drives/Dual (hot swappable) power supplies
Vibrint Tech-nologies	472	Mpression Com-prompter	News	4	Unlimited	800Mb/s per FC-AL	MPEG-2 4:2:2	1-40Mb/s	No	Fibre Channel, SCSI, ATM	2; 64-384kb/s	Yes	1 frame	Yes	Non-destructive	Sony 4:2:2, Louth, Odetics, Drake	RAID, NT backup, SCSI, tape

Table 1. This table lists key server manufacturers and their products. The information was supplied by respective vendors in response to a questionnaire supplied by *BE* staff editors. For more information, circle the appropriate free information number (see second column in table) on the Free Info Card on page 115.

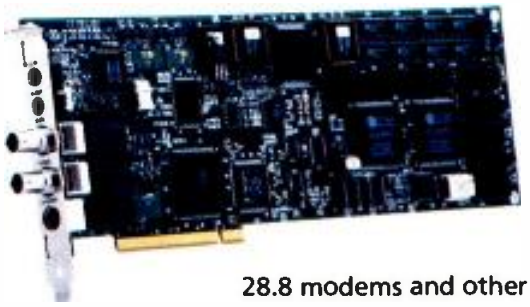
SWITCHABLE SDTV/HDTV RECORDING

Sierra Design Labs HD 1.5*Plus*: a video disk recording system that allows you to record in standard 601 or uncompressed DTV/HDTV video; using four of Sierra's Quick*frame* video disk recorders with a new Sierra HD processor, you can record up to 120 minutes of uncompressed HDTV video — or used separately, each Quick*frame* unit delivers standard D-1/ITU-R BT601-4 video; in HDTV mode, the HD 1.5*Plus* is a full-specification DTV recorder featuring record and playback of SMPTE 274M/292M 1920x1080 interlaced signals (1080i), with the ability to switch to SMPTE 296M 1280x720 progressive scan video (720p); the HD 1.5*Plus* is available in HD capacities starting in 10-minute increments (four times 15 minutes of SDTV) and requires 16 rack units of space with optional eight-channel audio; 702-831-7837; fax 702-831-5710

Circle (250) on Free Info Card

HIGH-QUALITY VIDEO ENCODER

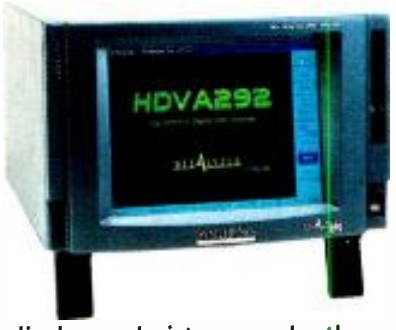
Optibase MPEG MovieMaker: a powerful, single-board MPEG-1 encoder that allows encoded video and audio to be distributed over LAN, T1/T2, ISDN, 28.8 modems and other communication media; digital filters reduce noise and improve MPEG-1 encoding; variable frame rate encoding allows you to adjust frame rates, and smart muxing removes the jerky motion of low bit-rate frame sampling to provide smooth playback of audio and video; 800-451-5101; fax 408-244-0545; www.optibase.com



Circle (253) on Free Info Card

TEST SYSTEM FOR HDTV

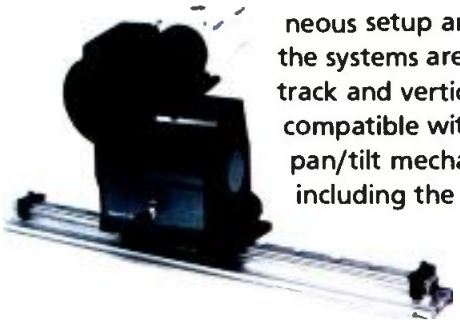
SyntheSys Research BitAlyzerHDTV (model HDVA292): a complete testing solution for high-definition TV signals; the BitAlyzerHDTV offers easy-to-use features by integrating a Windows-NT platform with advanced touchscreen control; it produces real-time error statistics for format errors and includes logic analyzer features for capturing errored data and analyzing it off-line; enhanced diagnostic features include digital waveform display, numeric display and picture mode; the instrument will also support future upgrades; 650-364-1853; fax 650-364-5716; www.synthesysresearch.com



Circle (251) on Free Info Card

ROBOTIC CAMERA TROLLEY SYSTEM

Telemetrics robotic camera trolley system: this enhanced trolley systems features programmable presets, as well as increased speed and quiet operation; additional benefits include instantaneous setup and shot-recall capabilities; the systems are available in linear, "H" track and vertical configurations and are compatible with the Telemetrics line of pan/tilt mechanisms and controllers, including the TM-CPS control-panel software; 201-848-9818; fax 201-848-9819; www.telemetricsinc.com



Circle (252) on Free Info Card

WORKSTATION WITH DUAL-STREAM UNCOMPRESSED VIDEO FOR WINDOWS NT

Intergraph Computer Systems StudioZ GT for SOFTIMAGE/DS: this Intel/windows NT-based workstation delivers dual-stream uncompressed video capability for non-linear production systems; additional enhancements to the new StudioZ GT for SOFTIMAGE/DS feature new display options that allow you to choose between dual 21-inch high-resolution monitors or a single 24-inch monitor; the PCI-based audio processing board supports eight channels of digital I/O and provides up to 16 tracks of simultaneous audio playback, as well as real-time mixing and digital audio effects; 800-763-0242; www.intergraph.com/ics/digitalmedia

Circle (254) on Free Info Card

UNIVERSAL DIGITAL VIDEO ROUTING

Nvision EnVoy series: this series of digital video routing switches features a high-speed crosspoint architecture that will handle data rates in excess of 1.5Gb; this structure is combined with various I/O modules to accommodate several data rates; with Envoy, you can route any standard-rate SDI signals and HD at 1.5Gb, within the same switch at the same time; you can also control the switch from an existing control system; 530-265-1000; fax 530-265-1010

Circle (255) on Free Info Card

DIGITAL MULTITRACK CONSOLE

Solid State Logic Axiom-MT: this digital multitrack console has up to 96 channels and all controls are dynamically automated, including the surround panning on large and small faders; the console features 48 multitrack buses, 12 main mix buses, 12 aux buses and more than 200 mix returns making it ideal for mixing to any format; the audio is kept in the digital domain with precise repeatability of level, EQ and dynamics; 200+ inputs can be controlled from a 48-fader control surface, and, in situations where space is even more limited, smaller frames can be specified; +44 1865 842300; fax +44 1865 842118; www.solid-state-logic.com

Circle (258) on Free Info Card

IOT POWER DEVICES FOR THE DIGITAL TV MARKET

Eimac Division of CPI DX (Digital eXcellence) family: an advanced line of inductive output tubes (IOTs) specifically rated for UHF DTV applications; the family consists of IOTs in liquid and air-cooled versions providing for average power approximately 10kW to 27kW and peak power handling from 40kW to over 110kW; 650-592-1221; fax 650-592-9988; www.eimac.com

Circle (257) on Free Info Card

REAL-TIME DIGITAL VIDEO NETWORKING SOLUTION

Optibase MPEG ComMotion UDP: an MPEG digital video transmission solution that encodes and sends high-quality MPEG-1 and MPEG-2 streams in real time over a broad range of standard TCP/IP networks; MPEG ComMotion UDP turns a Windows 95/NT PC into a complete transmission system; unicast, multicast and broadcast options allow you to customize videostreams to target a single PC station, a group of virtual stations that share a virtual IP address or to send simultaneously to all client stations; 800-451-5101; fax 408-244-0545; www.optibase.com

Circle (269) on Free Info Card

PRODUCTS NOW SHIPPING

MPEG-2 VIDEO EDGE DEVICE

Tektronix MS series: this series moves digital video material between facilities with higher quality at lower bandwidth; it is suitable for transmitting contribution-quality video at MPEG-2 4:2:0 or 4:2:2 from a studio to a satellite transmitter, from an event venue to a studio and/or from one post-production house to another; the series offers real-time video streaming over standard networks, including the MPEG-2 4:2:2 P@ML and is optimized to maintain video and audio quality even through multiple generations of encoding and decoding; 800-547-8949; fax 503-627-7275; www.tek.com

Circle (270) on Free Info Card

DUAL-STREAM VIDEO CAPTURE CARD NOW AVAILABLE

Pinnacle Systems ReelTime: a Windows-based, dual-stream video capture card with onboard real-time effects available in NTSC and PAL versions; this comprehensive desktop solution provides 130 real-time transitions, as well as real-time chroma, luma, linear keying and titling; it features a scalable architecture that supports Pinnacle Systems' Genie RT option enabling picture-in-picture motion and hundreds of digital 3-D effects, including page turns, water ripples, spheres, hourglass and bumps; composite, Y/C and component analog I/O interfaces are standard and optional interfaces include CCIR 601 serial digital and DV/1394; 650-526-1600; www.pinnaclesys.com

Circle (262) on Free Info Card

NEW SOFTWARE FOR SONY EDITSTATION

Sony ES-7 EditStation software version 1.2: this new software includes variable audio level settings using graphical "rubber-band" adjustments on the timeline, a timeline clip editor, timeline jogging by control-panel job dial, EDL export, reclip of multiple edit sequences in real time and inclusion of 38 additional digital effects; the additional features will help editors transition to non-linear; 800-686-SONY; www.sony.com/professional

Circle (263) on Free Info Card

NEW RELEASE OF AVID'S MACINTOSH-BASED DIGITAL VIDEO SYSTEM

Avid Xpress version 2.0: the Avid Xpress system, formerly MCXpress for Macintosh, is designed for independent video and multimedia producers; the new release includes significant enhancements to graphics and titling, audio, effects, overall editing and interoperation with third-party products; Xpress version 2.0 is available in four new configurations; 978-640-6789; fax 978-640-1366; www.avid.com

Circle (265) on Free Info Card

The GALLERY

Business

WCTV-TV, Tallahassee FL, and WYMT-TV, Hazard, KY, recently made Panasonic equipment purchases valued at over $1.1 million to convert news operations and commercial production to Panasonic DVCPRO. CBS affiliate WCTV received 58 pieces of DVCPRO equipment, comprised of two AJ-LT75 laptop editing systems, 11 AJ-D700 camcorders, 22 AJ-D750 and AJ-D650 studio editing VTRs and 23 AJ-D640 recorder/players. WYMT, a satellite CBS affiliate, purchased 41 units of DVCPRO gear, including an AJ-LT75, eight AJ-D700 camcorders, eight AJ-D750 and AJ-D650 editing VTRs, 11 AJ-D640 recorder/players and 13 AJ-D230 desktop VTRs.

KNWS-TV of Houston, and KLDT-TV of Dallas selected JVC's Digital-S as their digital recording format of choice. The two stations are owned by independent broadcaster, Johnson Broadcasting.

In addition, JVC announced that KNTS-TV, an independent start-up station in the greater Natchitoches, LA region, went on air with the Digital-S equipment as its house videotape format. KNTS is a community-based station affiliated with America One Television and owned by CP-Tel Broadcasting, a subsidiary of CP-Tel Holdings Inc., a local telco and Internet provider.

Philo Television purchased the Quantel Editbox digital nonlinear on-line editing system for its San Francisco facility. The Editbox, a complete hardware and software package made in England, is a key component in the $1 million renovation of Philo Television into a technically advanced, state-of-the-art editing boutique in Northern California. In addition to the Editbox, Philo offers four digital Avid Media Composer systems with both off- and on-line video editing capabilities.

Scitex announced that Brown Bag Films used two StrataSphere systems to create the 39-part TV series, *Twilight Works*. The two Scitex StrataSphere digital non-linear finishing workstations were used to complete the Action Heroes and Femme Fatales series of 30-minute celebrity biographies.

Scitex also announced that the MediaOne Cable Company acquired nine StrataSphere systems for its seven New England advertising locations.

360 Systems announced the installation of a Short/cut Personal Audio Editor for use on *The Late Show with David Letterman*. Short/cut joins the production's earlier purchase of three DigiCart/II hard disk audio recorders. Short/cut is a self-contained, two-track digital audio editor with built-in hard disk, speakers, a large waveform display and an optional Zip drive. It offers true cut/copy/paste editing, a scrub wheel and conventional tape transport control.

Avid Technology signed a definitive agreement to acquire the SOFTIMAGE subsidiary of Microsoft Corporation. The acquisition will strengthen Avid's presence in the TV market by allowing Avid to offer its customers comprehensive solutions for TV finishing and will add leading 3-D animation technology to Avid's product line. SOFTIMAGE develops 3-D animation, video production, 2-D cel animation and compositing software solutions for creative professionals.

Sony Electronics has integrated its broadcast, production and professional business into a seamless organization renamed Sony Broadcast and Professional Group (BPG). The business group is designed to meet the rapidly evolving requirements of the digital TV market, at the same time, BPG's sales operation will now be deployed into three zones.

Tektronix announced that it has a newly formed business unit, VideoTele.com, designed to tap into high-growth networking, telecommunications and broadcasting markets. VideoTele.com is a focused unit within the Tektronix Video and Networking Division and capitalizes on the company's position in the TV broadcast and broadband conferencing industries. It provides video communications products to service providers who can deliver Tektronix' broadcast-quality video as a service through its standard network infrastructure for end-users.

NVision announced that it will supply ABC Broadcast Operations a complete routing system for HD-SDI video, four levels of AES audio, time code and machine control. These routers will be controlled by their existing Tektronix SMS7000 control system. The package includes the new Envoy 6128 1.5Gb digital video routing switch that will be loaded initially for 32x32 operation, but with expansion to 128x128. AES audio will be switched via an NV3512 synchronous audio router and time code via a NV3064. Machine control will be accomplished via an NV3128 dynamic port data router.

The CNN News Group will install a Tektronix multichannel Profile system at its Atlanta-based CNN Center Operations. The multimillion-dollar project was designed by the Tektronix System Management Group and CNN to facilitate commercial spot delivery for its seven networks. The project will incorporate numerous Tektronix PDR200 MPEG 4:2:2 Profile video file servers, Profile fiber-channel networking, SGI Origin 2000 servers with shared RAID-

3 storage and an Ampex 812 data tape library system. The CNN News Group's Commercial Centralization Project is an expansion of CNN International's Profile system.

Digital Video Systems Inc. has changed its corporate name to DVS Digital Video Inc. The company remains a wholly owned subsidiary of the DVS GmbH of Hannover, Germany, and remains responsible for all sales and support of DVS and MMS products in North America. The DVS Digital Video staff, organizations, operations and customer relationships will remain unchanged.

Quantegy hosted a customer-appreciation party during the NAB convention in

Las Vegas at the Harley Davidson Café. Over 1,000 Quantegy professional media users attended the event. Quantegy is headquartered in Peachtree City, GA, with manufacturing facilities in Opelika, AL, and markets Quantegy and Ampex brand professional audio, video and instrumentation media products.

Solid State Logic announced that its Axiom-MT digital console will be installed in National Mobile Television's (NMT) all-digital HDTV mobile truck. The Axiom-MT, introduced at the recent AES Convention in Amsterdam, is a rugged digital audio platform providing engineers with a familiar work surface while addressing the space requirements of mobile broadcasting. The system will service broadcast audio for the Madison Square Garden Network over the next five years covering Knicks basketball and Rangers hockey games.

Telex has merged with EV International and will operate under the name Telex Communications Inc. The new company expects to have more than $355 million in sales and will employ approximately 3,300 people worldwide to manufacture a complete line of audio, wireless and multimedia communications equipment for its commercial, professional and industrial customers.

Euphonix installed a 104-fader CS3000B for *The Tonight Show With Jay Leno* stage for live-to-tape and on-air broadcast at the Burbank-based studio. The system includes features such as SnapShot Recall, Backstop fader PFL's and HyperSurround planning. NBC required the mixing system's capability to simultaneously broadcast in stereo, 5.1 surround sound or any future DTV or HDTV format.

Silicon Graphics and Philips Digital Video Systems announced a strategic alliance to develop mission-critical solutions for the worldwide broadcasting community. Under the terms of the alliance, Philips will integrate specific Silicon Graphics video computing platform software and hardware products into applications and systems that it sells in the broadcasting, cable and news media markets. The first collaboration between the two companies will be Philips' integration of the Silicon Graphics Origin200 server into its News*Breaker* news editor. Philips will also develop asset management applications with Silicon Graphics Studio-Central digital asset management software.

People

Robert Mueller has been named president of Panasonic Broadcast & Digital Systems Company, Secaucus, NJ.

Mel Lambert has been appointed to the newly created position of international marketing director at Otari Corporation, Foster City, CA.

Hewlett-Packard, Palo Alto, CA, has named Edward W. (Ned) Barnholt, HP executive vice president and general manager of the Test and Measurement Organization, to head a newly created Measurement Organization, formed by merging the Test and Measurement Organization and the Measurement Systems Organization.

In addition, Lewis E. Platt, HP chairman, president and CEO, will oversee Computer Organization on an interim basis.

Stephen King has been named vice president and general manager of Tektronix' newest business unit, VideoTele.com.

Lawrence S. Brody was elected president and chairman of the board at Communications Engineering Inc., Newington, VA.

SONY

DSR-200A
3-CCD Digital (DVCAM) Camcorder

Combining a compact and lightweight body with the superior picture quality of DSP (Digital Signal Processing) and the DVCAM format, the DSR-200A is the ideal acquisition tool for video journalists, event and wedding videographers, stringers and production houses. 500 lines of horizontal resolution, 48kHz or 32kHz digital audio, three hour record time, and minimum illumination of 3 lux is only the beginning. Other features include 16:9/4:3 capability, Steady Shot, high resolution 1-inch viewfinder, time code operation, time/date superimposition and an IEEE-1394 interface for direct digital output. Offers full automatic as well as manual control of focus, iris, gain, white balance and shutter speed.

- 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.
- 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.
- Has digital effects including audio and video fade, overlap and Slow Shutter.
- 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, built-in ND filter.
- Custom Preset function lets you preset, store and recall custom settings for color intensity, white balance (bluish or reddish), sharpness and brightness.
- 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.
- Has a large 1-inch B&W viewfinder with 550 lines of resolution for easy focusing even in low contrast lighting situations. Separate information sub panel displays time code, battery time, tape remaining and other camcorder functions without cluttering up the viewfinder.
- Records 16-bit/48kHz audio on one stereo track or 12-bit/32kHz with two pairs of stereo tracks (L1/R 1, 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° & 120°.
- 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.

DSR-200A Field Package:
- DSR-200A 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 an industrial grade DVCAM VCR that can be used for recording, playback and editing. DV standard 4:1:1 sampling digital component recording with a 5.1 compression ratio provides spectacular picture quality and multi-generation performance. It has a Control L interface for editing with other Control L based recorders such as the DSR-200A DVCAM Camcorder or another DSR-30. It also has a continuous auto repeat playback function making it ideal for kiosks and other point of information displays. Other features include high quality digital audio, IEEE-1394 Digital interface and external timer recording. The DSR-30 can accept both Mini and Standard DVCAM cassettes for up to 184 minutes of recording time, and can playback consumer DV tapes as well.

- Records PCM digital audio at either 48kHz (16-bit 2 channel) or at 32kHz (12-bit 4 channel).
- Equipped with Control L, the DSR-30 is capable of SMPTE Time Code based accurate editing even without an edit controller. Built in editing functions include assemble and separate video and audio insert.
- By searching for either an Index point or Photo Data recorded by the DSR-200A camcorder, the DSR-30 drastically cuts 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 locks ensures audio is fully synchronized with the video for absolute precision when doing an insert edit.
- 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.
- DV In/Out (IEEE 1394) for digital dubbing of video, audio and data ID with no loss in quality.
- 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-inch and 19-inch 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. The PVM-14N1U/20N1U are designed for simple picture viewing, the PVM-14N2U and 20N2U add RGB input and switchable aspect ratio.

They Feature:
- 500 lines of horizontal resolution
- They handle NTSC, NTSC 4.43, PAL, and SECAM.
- Picture (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.

PVM-14N2U/20N2U Only:
- (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.
- 4:3/ 16:9 switchable aspect ratio

PVM-14M2U/14M4U & 20M2U/20M4U
13-inch and 19-inch 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.

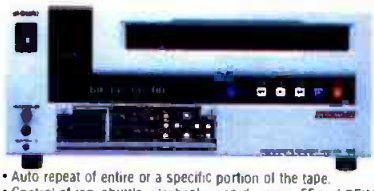
- HR Trinitron CRT enables the PVM-14M4U and 20M4U to display an incredible 800 lines of horizontal resolution. The PVM-14M2U and 20M2U offer 600 lines of resolution. M4 models also use SMPTE C phosphours for the most critical evaluation of any color subject.
- Dark tint for a higher contrast ratio (black to white) and crisper, sharper looking edges.
- Each has two composite, S-Video and component input (R-Y/B-Y analog RGB). For more accurate color reproduction, the component level can be adjusted according to the input system. Optional BKM-101C (video) and BKM-102 (audio) for SMPTE 259M serial digital input.
- Beam Current Feadback Circuit
- 4:3/16:9 switchable aspect ratio.
- True multi-system monitors they handle four color system signals: NTSC, NTSC 4.43, PAL, and SECAM.
- External sync input and outputcan 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).
- Blue gun, underscan and H/V delay capability
- On-screen menus for monitor adjustment/operation.
- Parallel remote control and Tally via 20-pin connector.

SONY UVW-100B

More affordable than ever, the UVW-100B offers 700 lines of horizontal resolution, 60dB S/N ratio, 26-pin VTR interface, compact design and ease of operation– making it ideal for field shooting applications.

- Three 1/2-inch IT Power HAD CCDs with 380,000 pixels attain sensitivity of F11 at 2000 lux (low light is 4 lux). S/N ratio of 60dB and 700 lines of resolution.
- Gain-up can be preset in 1dB steps from 1dB to 18dB.
- Auto Iris detects the lighting conditions and adjusts for the proper exposure.
- Clear Scan records computer monitors without horizontal bands across the screen. Shutter speed can be set from 60.4 to 200.3 Hz in 183 steps. Also has a variable high speed shutter from 1/100 to 1/2000 of a second.
- SMPTE LTC time code and UB generator/reader. Rec Run/Free Run, Preset/Regen are easily set. For multi-camera operation, genlock to an external time code is provided.
- Genlock input and built-in color bar generator.
- 26-pin VTR interface for feeding component, composite and S-Video signals to another VTR for simultaneous recording. Sart/stop are controlled and external VTR status such as Rec and Tally are shown in the viewfinder.
- Diecast aluminum, 1.5-inch DXF-601 viewfinder is rugged yet comfortable while providing 600 lines of resolution.
- Large diameter eye cup reduces eye strain and simplifies focusing. Diopter adjustments (-3 to 0) compensates for differences in eye sight.
- Zebra level indicators, safety zone and center marker generator. Shows tape remaining and audio levels.
- 8-digit LCD display indicates time data, warning indications and video status. Battery status audio level are also shown in a bar graph meter.
- With Anton/Bauer Digital Batteries remaining battery power is displayed on the LCD panel and through the viewfinder.
- Weighs 15lb. with viewfinder, battery, tape and lens. Shoulder pad is adjustable, so you maintain optimum balance when using different lenses and batteries.

UVW-1200/UVW-1400A
Betacam SP Player • Player/Recorder



The UVW-1200 and UVW-1400A are non-editing VCRs which deliver Betacam SP quality and offer features for a wide range of playback and recording applications. RGB and RS-232 interface make them especially ideal for large screen, high quality video presentation, scientific research and digital video environments.

- Ideally suited for work in computer environments, because RGB signals can be converted into component signals and vice versa with minimum picture degradation.
- 25-pin serial interface allows external computer control of all VCR functions based on time code information. Baud rate can be selected from between 1200 to 38,400 bps.
- Built-in Time Base Stabilizer (TBS) locks sync and subcarrier to an external reference signal as well as providing stable pictures. High quality digital dropout compensator further ensures consistent picture performance.
- Equipped with two longitudinal audio channels.
- Both read LTC Time Code) and UB (User Bits). The UVW-1400A also generates LTC and UB (Free-Run/Rec-Run).
- Built-in character generator can display VTR status, time code, self-diagnostic messages, set-up menu, etc.
- Auto repeat of entire or a specific portion of the tape.
- Control of jog, shuttle, playback, record, pause, FF and REW with the optional SVRM-100A Remote Control Unit.
- Composite and S-Video as well as component via BNCs which are switchable to RGB output. The UVW-1400A has two switchable sync connectors and a Sync on Green.
- Built-in diagnostic function and hour meter.
- Initial set-up menu for presetting operational parameters. Settings are retained even after power is turned off.

UVW-1600/UVW-1800
Betacam SP Editing Player • Betacam SP Editing Recorder

The UVW-1600 and UVW-1800 are the other half of the UVW series. They offer the superiority of Betacam SP with sophisticated editing features. They feature an RS-422 9-pin interface, built-in TBCs and Time Code operation. Inputs/outputs include component, composite and S-Video. **All the features of the UVW-1200/1400A *PLUS*—**

- Optional BVR-50 allows remote TBC adjustment.
- RS-422 interface for editing system expansion.
- Two types of component output; via three BNC connectors or a Betacam 12-pin dub connector.
- Frame accurate editing is assured, thanks to sophisticated servo control and built-in time code operation. In the insert mode of the UVW-1800, video, audio Ch-1/2 and time code can be inserted independently or in any combination.

PVW-2600/PVW-2650/PVW-2800
BETACAM SP 2000 PRO SERIES

Whenever versatility and no compromise performance is needed, there is only one choice. Legendary reliability and comprehensive support for its many users has established the PVW series as the standard in broadcast and post production. The PVW Series includes the PVW-2600 Player, PVW-2650 Player with Dynamic Tracking and the PVW-2800 Editing Recorder. They feature built-in TBCs, LTC/VITC time code operation and RS-422 serial interface. They also offer composite, S-Video and component video inputs and outputs. Most important they are built for heavy, every day duty.

- Built-in TBC's and digital dropout compensation assure consistent picture performance. Remote TBC adjustment can be done using the optional BVR-50 TBC Remote Control.
- The PVW-2600, PVW-2650 and PVW-2800 (generates as well) read VITC/ LTC time code as well as User Bits. Ext/Int time code, Regen/Preset, or Rec-Run/ Free-Run selections.
- Built-in character generator displays time code or CTL data.
- Set-up menu for presetting many functional parameters.

PVW-2650 Only
- Dynamic Tracking (DT) playback from -1 to +3 times normal speed.
- Two longitudinal audio channels with Dolby C- type NR.
- Recognizable monochrome pictures at up to 24X normal speed in forward and reverse. Color at speeds up to 10X.
- Two types of component connection: three BNC connectors or a Betacam 12-pin dub connector. They have composite and S-Video signals as well.

PVW-2800 Only
- Built-in comprehensive editing facilities.
- Dynamic Motion Control with memory provides slow motion editing capability.

UHF WIRELESS MICROPHONE SYSTEMS

Consisting of 5 handheld and bodypack transmitters and 6 different receivers, Sony's UHF is recognized as the outstanding wireless mic system for professional applications. Operating in the 800 MHz band range, they are barely affected by external noise and interference. They incorporate a PLL (Phase Locked Loop) synthesized control system that makes it easy to choose from up to 282 operating frequencies, and with the use of Sony's pre-programmed channel plan, it is simple to choose the correct operating frequencies for simultaneous multi-channel operation. Additional features, like space diversity reception, LCD indicators, reliable and sophisticated circuit technology ensure low noise, wide dynamic range, and extremely stable signal transmission and reception. Ideal for broadcasting stations, film production facilities, and ENG work.

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Panasonic

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, eight background colors available). • Digital effects: strobe, still, mosaic, negative/positive, paint, B&W, strobe, trail, and AV synchro.
- Real-Time Compression - entire source image is compressed inside a wipe pattern.
- Fade-in and fade-out video, audio, titles individually or synchronously faded. • Down Stream keyer with selectable sources from character generator or external camera.
- "Scene Grabber" moves a pattern while upholding the initially trimmed-in picture integrity.
- 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.

Canon

IF+ Series Zoom Lenses

Canon's IF+ family of lenses are engineered to meet the needs of the next generation of broadcasting while meeting the standards of today. Besides having the widest wide angle lens available, the IF+ lens series have wider angles at shorter M O D (Minimum Object Distance), provide higher MTF performance and incorporate Hi-UD glass for reduced chromatic aberration. In addition to superb optics they're all designed with Canon's "Ergonomic Grip" for fatigue-free shooting over an extended time. IF+ lenses are your assurance of unsurpassed quality and performance for today and tomorrow.

J15ax8B

A next generation internal focusing lens with the shortest MOD and widest angle of any standard lens, the J15ax8B IRS/IAS is a standard ENG lens that lets you shoot in tight or restricted areas at the closest minimum object distance ever possible and capture more of the subject. It incorporates all the great features of IF+ lenses including a built-in 2X extender, high MTF performance, Hi-UD glass, square lens hood and Canon's "Ergonomic Grip."

J20ax8B IRS/IAS

Excellent for ENG, sports and production, the J20ax8B IRS/IAS lets you squeeze in shots from 8mm and still take you all the way out to 320mm with its built-in extender. Incorporates all IF+ features, plus is the only lens (besides the J9ax5.28 IRS/IAS) with aVari-Polar lens hood, enabling rotation of attached filters.

GLIDECAM INDUSTRIES

V-16 AND V-20

Camera Stabilization Systems

The V-16 and V-20 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. The 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. 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.

sachtler

CADDY systems

Sachtler quality is available to low budget users. The price of a CADDY system includes the 7-step dampened CADDY fluid head, ultra-light but rugged carbon fiber tripod, lightweight spreader and either a soft bag or cover. The CADDY fluid head features an adjustable pan arm, 7-step adjustment for quick counter balance and the self-locking Sachtler Touch and Go System.

CAD 01 Single-Stage ENG Carbon Fiber System:
- CADDY Fluid Head • ENG Single-Stage Carbon Fiber Tripod
- SP 100 Lightweight Spreader • Transport Cover 100

CAD 2A 2-Stage ENG Carbon Fiber System:
- CADDY Fluid Head • ENG 2-Stage Carbon Fiber Tripod
- SP 100 Lightweight Spreader • Soft padded ENG Bag

MILLER

Fluid Heads and Tripods

Miller 20 -Series II Fluid Head

- Dynamic fluid drag control
- Sliding/quick release camera platform
- Weighs 4 lbs. • handles up to 22 lbs.
- Counterbalance system compensates for nose heavy or tail heavy camera configurations and permits fingertip control of the camera throughout the tilt range.
- Includes independent pan and tilt locks, bubble level, dual pan handle carriers and integrated 75mm ball leveling.

Miller 25-Series II Fluid Head

- 100mm ball level fluid head • Robust, lightweight, low profile design
- Quick release camera platform • Weighs 7lbs., handles up to 25 lbs.
- Multi-step fluid drag system and integrated counterbalance system provide ultra-smooth, repeatable pan-and-tilt fluid control and finger-tip camer balance for ENG camcorders, industrial CCD cameras or small studio cameras.

#601-Lightweight Tripod

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

#649-2-Stage Tripod

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

System 20 #338—Miller 20 Head, 601 Lightweight Tripod, On Ground Spreader
System 20 ENG #339—Miller 20 Head, 649 2-Stage Aluminum, On Ground Spreader
System 25 #500—Miller 25 Head, 611 Lightweight Tripod, On Ground Spreader
System 25 ENG #502—Miller 25 Head, 641 2-Stage Aluminum, On Ground Spreader

Vinten

Vision SD 12

Pan and Tilt Head with Serial Drag

The Vision SD 12 head features "Serial Drag" pan and tilt system. System consists of a unique, permanently-sealed fluid drag and an advanced lubricated friction drag. You achieve the smoothest pans and tilts regardless of speed, drag setting and ambient temperature.
- Patented spring-assisted counter-balance system permits perfect "hands-off" camera balance over full 180° of tilt
- Instant drag system breakaway and recovery overcome inertia and friction for excellent "whip pans"
- Consistent drag levels in both pan and tilt axis
- Flick on, flick off pan and tilt caliper disc brakes
- Greater control, precision, flexibility and "touch"
- Touch activated, time delayed illuminated level bubble
- Working conditions from as low as -40° up to +60°C
- SD 12 weighs 6.6 lbs and supports up to 35 lbs.

Vision 12 Systems

Vision 12 systems include #3364-3 SD 12 dual fluid & lubricated friction drag pan/tilt head, single telescoping pan bar & clamp with 100mm ball base.

SD-12A System
- SD-12 pan and tilt head
- 3518-3 Single stage ENG tripod with 100mm bowl
- 3363-3 Lightweight calibrated floor spreader.

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

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

The ultimate in lightweight and innovative tripods, they are available with durable tubular alloy (Model #3513) or the stronger and lighter axially & spirally wound carbon fiber construction (Model #3523). They incorporate torque sate clamps to provide fast, safe & self-adjusting leg clamps.
- "Torque Sate" requires no adjustment. Its unique design adjusts itself when required, eliminating manual adjustment and maintenance and making for a much more reliable clamping system.
- New hip joint eliminates play and adds rigidity.
- They both feature 100mm levelling bowl, fold down to a compact 28" and support 45 lbs.
- #3513 weighs 6.5 lbs - #3523 CF (Carbon Fibre) weighs 5.2 lbs.

VIN-5ST and VIN-10ST

- Compact & lightweight, they maintain Vision performance and quality
- Provide total stability and durability with payloads up to 33 lbs.
- Ideal for the latest generation of dockable and one-piece camcorders
- Compatible with all Vision accessories.

VIN-5ST includes Vision 5LF head, single stage toggle clamp tripod, spreader and soft case.
VIN-10ST includes Vision 10LF head, single stage toggle clamp tripod, spreader and soft case.

anton bauer

DIGITAL Gold Mount Batteries

Acknowledged to be the most advanced battery in the industry, the Logic Series 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

fuji

Professional Grade VHS

PG-30	2.39	PG-60	2.59	PG-120	2.79

Broadcast Grade VHS Box

BGR-30	3.59	BGR-60	4.29	BGR-120	4.99

H471S S-VHS Double Coated

ST-30	6.99	ST-60	7.49	ST-120	7.99

M221 Hi 8 Double Coated

Metal Particles			Metal Evaporated		
P630HMP		4.99	E630HME		8.39
P660HMP		6.49	E660HME		10.49
P6120HMP		8.49	E6120HME		13.99

M321SP Metal Betacam (Box)

05S	17.95	10S	18.49	20S	19.95
30S	22.95	60L	31.95	90L	49.95

DP121 OVC PRO

12M (Med.)	8.29	23M	9.79	33M	12.99
63M	22.49	64L (Lg.)	23.99	94L	33.99
123L					43.99

maxell

Hi8 Metal Particle (XRM)

P6-120 XRM					6.99

Broadcast Quality Hi8 Metal Particle

P6-30 HM BQ		5.39	P6-60 HM BQ		6.09
P6-120 HM BQ					7.99

P/O 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	16.99	B60MLSP	27.99	B90MLSP	39.99

Panasonic

Mini DV Tape

AY DVM-30		9.99	AY DVM-60		11.99

OVCPRO

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

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)		13.29
BCT-20M (small)		13.99	BCT-30M (small)		14.99
BCT-30ML		21.49	BCT-60ML		23.49
BCT-90ML					34.99

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		26.95	DV-180MEM		34.95

POV Series Professional OVCAM Tape

PDVM-12ME (Mini)		19.50	PDVM-22ME (Mini)		22.95
PDVM-32ME (Mini)		24.95	PDVM-40ME (Mini)		26.95
PDV-64ME (Standard)		34.95	PDV-94ME (Standard)		36.95
PDV-124ME (Standard)		39.95	PDV-184ME (Standard)		49.95
PDVN-64N	27.50	PDVN-124N	34.95	PDVN-184N	43.95

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NewTek

Calibar 3-Oz. Pocket-Sized Test Generator

The size of a ball point pen and running on a single battery, Calibar is an NTSC test signal generator that packs a rack mount's worth of test equipment into a battery operated instrument. Calibar is the fastest, easiest and most portable way ever to calibrate video equipment. No patch bay racks. Just one cable. So besides giving you fast, accurate readings in the studio, it's perfect for off-site events or trouble-shooting in the field.

- Designed for studio and field operation, it produces 24 test pattern functions at the touch of a button. 10-bit precision digital-to-analog conversion assures highly accurate signals.
- Calibar's combination of low cost, portability and full-featured operation makes it ideal for broadcast engineers, television production facilities and video post houses.
- Tuck Calibar in your pocket and you're ready to go. Touch the button to generate SMPTE color bars, touch it again to calibrate convergence and so on.
- With the supplied AC adapter, it also functions as a black burst generator.

CHYRON PC-CODI & PC Scribe

Text and Graphics Generator and Video Titling Software

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. Combined, their a total solution for real-time character generation with the quality you expect from Chyron.

PC-CODI Hardware:

- Fully-anti-aliased displays • Display and non-display buffers
- Less than 10 nanosecond effective pixel resolution
- 16.7 million color selections • Fast, realtime operations
- Character, logo and PCX image transparency
- Variable edges: border, drop shadow and offset
- Full position and justify control of character and 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
- Software controlled video timing
- User definable read effects playback: wipes, pushes, fades
- NTSC or PAL sync generator with genlock
- 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:

- Number of fonts is virtually unlimited. Also supports most international language character sets. Fonts load instantly and the level of anti-aliasing applied is selectable
- Adjust a wide range of character attributes. Wide choice of composition tools.
- Character words, rows and fields can color flash
- 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
- Multiple preview windows can be displayed simultaneously.
- Transitions effects include: cut, fade, push, wipe, reveal, peel, zoom, matrix, wipe, spiral, split, weave and jitter.
- Import elements to build graphics. This includes OLE objects, INFINITI RGBA and TGA with alpha channel. Scribe also imports and exports TIFF, JPEG, PCX, TGA, BMP, GIF, CLP, ASCII, IMG, SGI, PICT and EPS formats.

PC-CODI and PC-Scribe Bundle.....2995.00

TRUEVISION / AVID

TARGA 1000/MCXpress NT

Professional Video Production Workstation

Incorporating the award-winning TARGA 1000 video card and Avid MCXpress NT non-linear editing software, this fully-configured workstation meets the needs of production professionals, corporate communicators, educators and Internet authors.

TARGA 1000 Features:

The TARGA 1000 delivers high processing speed for video and audio effects, titling and compositing. Capture, edit and playback full-motion, full-resolution 60 fields per second digital video with fully synchronized CD-quality audio.

- Compression can be adjusted on the fly to optimize for image quality and/or minimum storage space. Has 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. Delivers perfectly synchronized audio and video.

MCXpress Features:

The ideal tool for video and multimedia producers who require predictable project throughput and high-quality results when creating video and digital media 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. Offers integration with third-party Windows applications, professional editing features, powerful media management, title tool and a plug-in effects architecture. It also features multiple output options including so you save time and money by reusing media assets across a range of video and multimedia projects.

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" Floppy 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

KNOX VIDEO

RS4x4/8x8/16x16/16x8/12x2

Video/Audio Matrix Routing Switchers

Knox's family of high performance, 3-channel routing switchers are extremely versatile, easy-to-use and very affordable. Housed in an ultra-thin rackmount chassis they accept and route (on the vertical interval) virtually any video signal, including off-the-air and non-timebase corrected video. They also route balanced or unbalanced stereo audio. The audio follows the video or you can route the audio separately (breakaway audio). Each of the switchers offers manual control via front panel operation. They can also be controlled remotely by a PC, a Knox RS Remote Controller, or by a Knox Remote Keypad via their RS-232 port. Front panel LEDs indicate the current routed pattern at all times. Knox switchers are ideal for applications such as studio-feed control and switcher input control, plus they have an internal timer allowing timed sequence of patterns for surveillance applications as well.

- Accept and routes virtually any one-volt NTSC or PAL video signal input to any or all video outputs.
- Accept and route two-volt mono or stereo unbalanced audio inputs to any or all audio outputs.
- Video and audio inputs can be routed independently - they don't need to have the same destination.
- Can store and recall preset cross-point patterns. (Not available on RS12x2.)
- Front panel key-pad operation for easy manual operation
- Can also be controlled via RS-232 interface with optional RS Remote Controller or Remote KeyPad.
- Front panel LED indicators display the present routing patterns at all times.
- An internal battery remembers and restores the current pattern in case of power failure.
- Internal vertical interval switching firmware allows on-air switching.
- Housed in a thin profile rackmount 1" chassis.
- Also except the RS12x2 are available in S-Video versions with/without audio.
- Models RS16x8 and RS16x16 are also available in RGB/component version.
- With optional Remote Video Readout, the RS16x8 and RS16x16 can display active routes on a monitor at remote locations, via a composite signal from a BNC connector on the rear panel.
- The RS4x4, RS8x8 and RS16x16 are also available with balanced stereo audio. They operate at 660 ohms and handle the full range of balanced audio up to +4 dB with professional quick-connect, self-locking, bare-wire connectors.

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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 Diff-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, 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 1125/30 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

All the operating advantages of the 5870 except SCH is deleted (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 genlock 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.

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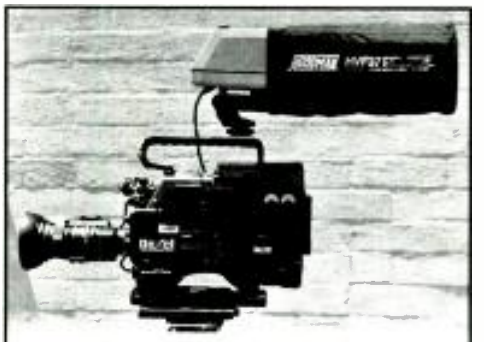

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Help Wanted

MAINTENANCE ENGINEER FT for maintenance/operation of radio/TV studio; transmitter facilities including terminal/STL equipment; & the mechanical/electrical systems located at those facilities. Send cover letter, resumes to Maintenance Engineer Search, WSKG, PO Box 3000, Binghamton, NY 13902. NO CALLS. EOE/AA.

Help Wanted

WTAE-TV

The Hearst-Argyle, ABC affiliate in Pittsburgh, is seeking experienced individuals for the following positions:

TV MAINTENANCE ENGINEER: Ideal candidate would be familiar with small-format tape machines, switchers, audio consoles, studio cameras, ENG, SNG, and automation equipment. Should have strong interest in computers and digital technology. Minimum three (3) years' experience. SBE certification preferred. Code #ME-0527.

TV TRANSMITTER SUPERVISOR: Seeking an experienced transmitter maintenance supervisor to operate and maintain all station transmitter facilities. Minimum four (4) years' experience with STL microwave, VHF and UHF transmitters required. Must have excellent record-keeping skills and a good working knowledge of FCC rules. Should have good mechanical skills. FCC General Class License required. Computer experience and SBE certification preferred. Code #TS-0224.

For consideration, send resume and cover letter including source of referral to the applicable Code #, c/o WTAE-TV, 400 Ardmore Blvd., Pittsburgh, PA 15221. No phone calls, please! EOE.

VIDEO MAINTENANCE ENGINEERING TECHNICIAN
To install, repair, maintain, upgrade & operate electronic equipment used in cable TV broadcasts, including microwave transmission equipment. Test audio & video equipment for proper performance & compliance with FCC regulations, diagnosing & correcting any technical problems or malfunctions. Maintains & calibrates instruments used to test equipment. Determines proper test sequences & conditions & records & analyzes test data. Oversees and trains production crew & technicians in use of test equipment. Provides technical advice on instrumentation & equipment procurement. Oversee & enhance clarity of images produced by microwave transmission. Modifies equipment, including power sources as necessary. Requirements: Bachelors degree in Broadcast Technology or EE. No experience required. Candidate must possess demonstrated expertise using impedance analyzer, Huntron tracker 1000, and Tektronix Pathfinder; and demonstrated expertise using waveform monitor/vectorscope & microwave spectrum analyzer. The expertise required must be sufficient to train technical staff and TV production crew to use listed equipment in production conditions. Job Site location: Norwalk, CT. Sal: $50,189/yr, OT $27.14/hr as required. Work schedule: 6am to 3pm, M-F. Send resume & cover letter documenting minimum qualifications to: Attn: Job Order #3212992, Program Support - 3rd fl., CT Dept. of Labor, 200 Folly Brook Blvd, Wethersfield, CT 06109. Applicants will be required to present proof of legal authority to work in the U.S. EOE.

WANTED CHIEF ENGINEER Growing UHF station in small midwestern market looking for a high energy individual. We need a person that has hands on experience, but can build a great engineering department. The right person should have experience overseeing building projects, good communication skills and the desire to work as part of the team. Send resume to Owl Engineering, 8899 Hastings St. N.E., Minneapolis, MN 55449

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Help Wanted

MAINTENANCE ENGINEER WXIA-TV is looking for a maintenance engineer to provide technical support for all station activities with primary support to news operation and programming. Responsibilities include repairing and installing a wide variety of television broadcast equipment. A minimum of five years broadcast maintenance experience or commensurate education and/or experience in a related field required. Must be able to troubleshoot state of the art electronic equipment to component level with minimal supervision. Familiarity with E.N.G. recording, editing and RF equipment is essential. Applicants should also have a solid working knowledge of PCs and typical PC software. Send resume and salary requirements to: WXIA-TV, Attn: Paul Tanton Engineering Supervisor, P.O. Box 77010, Atlanta, GA 30309. No phone calls please. EOE M/F

MAINTENANCE ENGINEER Full time position available 39 miles from Pittsburgh, PA. Requires ability to repair to component level in all aspects of broadcast plant. Knowledge of current computer operating systems a plus. Send resume and salary requirements to: Sondra Nestor, Human Resources, WTOV-TV, Box 9999, Stuebenville, OH 43952. EOE. No phones call please!

ENGINEERING SUPERVISOR WTTG is seeking an individual with 5 years exp. in a supervisory position at a television station or production facility to supervise and schedule technicians working under a labor agreement. Additionally, this person will participate in the design and implementation of facility equipment changes including digital TV. Candidate should be well versed in PC operating systems and programs. Experience with UHF transmitter is a plus. We offer a competitive salary and benefits package. Please send your confidential resume to: Mary Talley, VP/HR, WTTG/FOX TV 5151 Wisconsin Ave, NW Washington, DC 20016 re: Eng. Supv. EOE/M/F/D/V.

MAINTENANCE TECHNICIAN WTTG has an excellent opportunity for an experienced Maintenance Technician to work in its Washington, DC digital studio facility. Candidate should have at least 5 years experience in installing, repairing, and maintaining analog and digital audio/video systems, computer proficiency and UHF transmitter experience desirable. We offer competitive wages and benefits. Please send your confidential resume to: Mary Talley, VP/HR, WTTG/FOX TV-5151 Wisconsin Ave. NW Washington, DC 20016 re: Maintenance Eng. EOE/M/F/D/V.

MAINTENANCE TECHNICIAN Requires self starter having experience with Beta, VPR-3, PC's and other studio equipment maintenance. Experience with microwave, satellite, VHF & UHF transmitters, CADD ability and FCC General Class License preferred. Contact Marty Peshka, Director of Engineering, WTNH-TV, 8 Elm Street, New Haven, CT 06510. No phone calls please. EOE.

TV ENGINEERS WANTED for satellite television stations in Charlotte NC, Atlanta GA, Houston TX, Las Vegas NV and St. Louis MO. Provide maintenance and monitoring services and report to national program group. TV rf experience required. Microwave and satellite knowledge very helpful. These positions require approximately 6 hours per month. Monthly retainer plus hourly rate. Local residency required for quick response and monitoring. EOE. For further information contact tvjob@hotmail.com.

BROADCAST MAINTENANCE TECHNICIAN NBC O&O in Miami, FL has an excellent opportunity for a team oriented, hands-on broadcast engineer. The candidate must have experience in component level maintenance on all broadcast video and audio equipment. Send resume to Employee Relations Manager, NBC 6, 316 No. Miami Ave., Miami, FL 33128. NBC 6 is an equal opportunity employer.

FOX27 KDEB has an opening for a full-time Maintenance Engineer with solid electronics background, as well as proficiency in installation, service, repair, and operation of electronic and/or TV broadcast equipment. Excellent benefits, inc. 401k. 3000 East Cherry, Springfield, MO, 65802. EOE

ASSISTANT CHIEF ENGINEER WDWB-TV, WB20, Granite Broadcasting is seeking a strong second for its WB affiliate in Detroit. Requires solid maintenance and RF background, minimum 5-7 years experience. Must be able to work for and lead a team. Previous supervisory experience a plus. No phone calls please. Send resume to: Asst. Chief Engineer, WDWB-TV, HR Dept. - BE, 27777 Franklin Rd. #1220, Southfield, MI 48034. WDWB, Granite Broadcasting Is An Equal Opportunity Employer.

MAINTENANCE TECHNICIAN WHAS-TV11, Belo station in Louisville, KY is looking for an experienced technician who likes challenges. You should have 3-5 years experience in installation and maintenance of broadcast equipment. Must work well under pressure as part of a team with heavy emphasis to support a winning news operation. Must be a self-starter requiring minimal supervision while producing high quality results. EOE. Send cover letter and resume to: Cindy Vaughan, HR Director, HR 98-5, WHAS-TV, 520 W. Chestnut St., Louisville, KY 40202.

CHIEF ENGINEER KLTJ-TV has an opening for an engineer to oversee all of its broadcast operations. Responsibilities will include the repair and maintenance of the station's transmitter and studio equipment, so experience with broadcast transmitters is necessary. The successful candidate should also be familiar with DTV technology and computer networking. For consideration send your resume to: Andrew Bless, Station Manager, KLTJ-TV, 1050 Gemini, Houston, TX 77058 or fax to 281-212-1022. Equal Opportunity Employer.

ASSISTANT DIRECTOR OF ENGINEERING Major NYSE group television broadcaster seeks a "hands-on" Assistant Director of Engineering for the group, based in Los Angeles. You will work with and travel to all our major market "O&O's". The ideal candidate will have 5-10 years experience as Chief or Assistant Chief Engineer working in UHF stations. Excellent salary and benefits. Fax resume to (310) 348-3659 - EEO

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CHIEF ENGINEER Newschannel 5 is seeking an experienced technical manager to be responsible for the technical stability of the television station and play a significant role in our transition to digital TV. Should have significant experience in broadcast engineering, including maintenance, News, and production operations. A degree in a technically related field is preferred, but not required. Experience with Capital planning and budgeting is a plus. Send a resume to: General Manager, KALB-TV 5, PO Box 951, Alexandria, LA 71309. Newschannel 5 is a Media General station and an EEO Employer. Pre-Employment Drug-Testing required.

BROADCAST TECHNICIANS The National Digital Television Center is looking for broadcast technicians. The successful candidates will have two plus years experience in component level VTR repair (Beta, Digital Betacam, etc.) and video monitor repair. Tektronix Profile and Alamar automation experience highly desirable. A high level of digital and analog audio and video knowledge and computer skills essential. A drug test and background screen will be required of all successful candidates. Send resumes to: TCI-NDTC, 4100 East Dry Creek Road, Room 118/Attn: Rodney Beelow, Littleton, CO 80122. EOE

TELEVISION BROADCASTING MAINTENANCE TECH MIN QUALS: Assoc deg in electronics or equiv. 4-6 years exp in repair and maint of broadcast equip. Must be flexible. DESIRED QUALS: Knowledge of analog and digital equip, SONY vtrs, Alamar automation, Satellite & fiber Transmission systems. CAD exp a plus. An interview will be required of all successful applicants. Special accommodations will be made for any interviewee who requires it. TCI requires a pre-employment drug test. E.O.E. Interested applicants, send resume & salary requirement to: TCI-NDTC, 17 Battery Place, suite 232, NY, NY 10004 Att: HR. No phone calls accepted!

Classifieds

Help Wanted

MAINTENANCE ENGINEER Full time maintenance engineer is wanted by production company in Nashville that produces national television programming. Five years broadcast maintenance experience required. Must be able to troubleshoot at the component level and be computer literate. Salary commensurate with experience. Apply to Steve Anderson, Operations Manager, Jim Owens and Associates, 1525 McGavock St., Nashville, Tn 37203.

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. WXXI is an equal opportunity employer.

ENGINEERING MAINTENANCE TECHNICIAN Able to install, repair and maintain various types of broadcast equipment including, but not limited to tape machines; switchers; DVE; video monitors; related terminal gear. Odetics TCS-90 knowledge a plus. Able to work w/video servers and Avid systems. Requires two years experience w/live broadcast/ENG; working knowledge of broadcast systems; willing to work nights/weekends; good driving record. Send resume to: Engineering Department MAC America Communications P.O. Box 5068 Phoenix, Arizona 85010

CHIEF ENGINEER KOLO/TV NewsChannel 8, in beautiful Reno, Nv. has an immediate opening for a Chief Engineer. Strong background in transmitters and RF maintenance, familiar with latest technological advances. Willing to lead facility through the conversion to digital and HDTV. Team leadership, good communicator and teacher. Thorough knowledge of computers and computer based systems; Novell and Microsoft, newsroom and studio systems maintenance. Translator and microwave knowledge helpful. Must be fully versed in FCC regulations. General Class FCC license and/or SBE certification is required. Resume to: Faye H. Kitchel, Human Resources KOLO/TV P.O. Box 10,000 Reno, Nv 89510 EEO

CHIEF ENGINEER ZDTV, Your Computer Channel, based in San Francisco, seeks a seasoned, team-oriented, hands-on engineer to be responsible for the studio and broadcast engineering department. You will be responsible for maintaining and installing technical facilities for the studio, maintenance department and air operations management. You will have excellent technical and managerial skills, plus a thorough knowledge of broadcast equipment including satellite transmission, computer and Internet systems. FCC license and college or technical degree or equivalent needed. At least 10 years' broadcast engineering experience preferred. Please send resume to: ZDTV, Attn: Human Resources/BCE, 650 Townsend St., San Francisco, CA 94103. Email: HR@ZDTV.com, fax: 415-551-4501. No phone calls please. An Equal Opportunity Employer.

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We offer a competitive starting salary and an excellent benefits package including a 401(k) plan. Please send your resume in confidence with salary requirements to: **Home Box Office, 1100 Avenue of the Americas, NY, NY 10036. Att: CBLI-H3-12B.** Home Box Office, a Time Warner Entertainment Company, is an EOE, M/F/D/V.

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POSITION: Immediate opening for a highly motivated experienced broadcast engineer for new mobile broadcast truck and state-of-the-art digital television systems. Requires familiarity with transmitter, video, audio, control, and satellite equipment. Recent station experience a plus. Understanding of current digital broadcast technology and knowledge of the ATSC television standard essential. Must be able to present demonstrations and technical training material to broadcasters. SBE TV Certification or FCC General Class license preferred.

Duties will include hands-on digital television system implementation, testing, and trouble-shooting, management of on-site technical and maintenance programs, DTV demonstrations and presentations, coordination of set-up and tear-down of road show.

TRAVEL: Extensive travel will be required. (Usually the schedule will be three weeks of travel and then one week off.)

DURATION: This will be a position lasting approximately 13 months.

URGENCY: Review of resumes will begin immediately.

RESPONSE: If you are interested, please submit your resume and salary requirements to:
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Harris Corporation
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Federal Bureau of Investigation

The FBI is seeking experienced audio and video engineers for its forensic analysis program. Work involves high profile national security and criminal cases. Positions are located in rural Virginia at the FBI's Engineering Research Facility in Quantico.

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Additional responsibilities include providing courtroom presentations, providing expert testimony, and guiding technology research programs. A technical Bachelor's Degree required with advanced degree preferred. Salary is based on education and experience. Send resumes to:
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SUBSCRIPTIONS: Non-qualified persons may subscribe at the following rates: United States and Canada; one year, $55.00. Qualified and non-qualified persons in all other countries; one year, $70.00 (surface mail); $130.00 (air mail). Subscription information: P.O. Box 12937, Overland Park, KS 66282-2937.

BROADCAST ENGINEERING (ISSN 0007-1994) is published monthly (except semi-monthly in May and December) and mailed free to qualified persons by Intertec Publishing, 9800 Metcalf, Overland Park, KS 66212-2215. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canada Post International Publications Mail (Canadian Distribution) Sales Agreement No. 0956295. POSTMASTER: Send address changes to *Broadcast Engineering*, P.O. Box 12902, Overland Park, KS 66282-2902. CORRESPONDENCE: Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2215. Phone: 913-341-1300 Edit. fax: 913-967-1905. Advert. fax: 913-967-1904. © 1998 by Intertec Publishing. All rights reserved.

EOM

Setting new TV standards

BY PAUL MCGOLDRICK

As expected, the "Video and Broadcast Components" chapter of the *PC 99 System Design Guide* was published near the end of April, allowing for last-minute input from this year's NAB. The final version of the guide will define what PCs will look like and what they will do next year.

There are three different PC definitions: Consumer PC 99, Office PC 99 and Entertainment PC 99. The Consumer PC 99 is going to be an entry-level machine, while the Office PC 99 will be heavy on office applications. The latter one, the Entertainment PC 99, is what everyone will hope to sell — and it is also the one to watch.

You should not be surprised that the document clearly lays out a path to replace any existing ideas of what a TV receiver system is all about. If you were expecting to go out next year to buy that DTV receiver with the separate satellite receiver and the DVD player, have the tranquilizers ready. That's not how Wintel wants it to be. And when you get such large groups of PC manufacturers in agreement, it will happen. Think the PC industry is not ready for this step? Then let's straighten out a few curves here.

This Entertainment version of PC 99 *requires* the PC to have the following capabilities: playback of MPEG-2 video from DVD, playback of video from DTV broadcasts, analog video input and capture, analog TV tuner, bus mastering of MPEG sources, ability for the CPU to de-multiplex MPEG transport streams, DV decoding and encoding, de-interlacing of SDTV and MPEG-2 playback — without interference from background tasks. Items that are recommended include: digital satellite reception, digital cable reception and ATSC DTV support.

Is there anything inherently difficult about incorporating these features? No. Most are already down to a chip or two. Video capture can be a direct software function or it can be in one chip from AverLogic. For another $7, you can buy their de-interlacer as well. Satellite reception down to the decoding stages now only requires two ICs thanks to Broadcom and Philips. There are plenty of decoding ICs to choose from, and there are a number of superchips for interactive digital cable. MPEG-2 decoding is available in a number of single-chip solutions. But wait, now you don't need application-specific hardware at all. For several months, Intel has been quietly shipping a software application to decode MPEG-2 on a Pentium-II.

The document lays out a path to replace any existing ideas of what a TV receiver system is all about.

Although the system specification does not note any specific audio decoding, other than the ability to handle it, there are several Dolby-approved software applications for that. The carry-over PC 98 specs allow for other sources, as well as the mixing and monitoring of them. There is also a continuing pressure to facilitate VBI reception and instructions for 4X oversampling of the VBI data.

The preamble to the chapter (Chapter 15) is one of the best clues as to where Wintel sees the entertainment PC going. Issues include "Increased use of multiple screens and their associated display controllers. This would allow a PC in the den running a word processing application to simultaneously supply a TV in the family room with a DVD movie or TV content." Also, "Gradual separation of receiver functions from display functions. The two will be linked by software running on the host processor. This allows different MPEG elementary streams, such as video, audio and data, to be sent to the appropriate subsystems within the PC. It also prepares the way for the longer range goal of a video home network."

It is interesting, but not surprising, that the specification does not address the essentially incompatible 1,080i, other than to mention "higher ATSC formats are allowed." This adds to the pressure being put on the declared 1,080i players to change their ways. That is going to be interesting to watch.

If you are in the business of consumer appliances and think that this joint venture between Microsoft and Intel is just a lower-quality entertainment system, think again. The specification goes to great lengths to explain the possible business models with "new revenue opportunities for participating manufacturers." It also stresses that the specifications "add features while introducing PCs to these traditional areas without taking away any TV features. In particular, this means that the PC must meet or exceed the video and audio quality of traditional consumer appliances."

There can be no doubt that this approach, hardly unexpected, will rock the consumer electronics industry, which will evolve as a giant add-on feature industry for Wintel — or it will end up in a continuing legal battle. If it goes the legal route, I personally think it will be a much longer and more expensive battle than the browser wars, *and* it will be complicated by a sense of patriotism for Wintel.

You can find Chapter 15 of the *0.7 Review Draft of the PC 99 System Design Guide* at Intel's web site: http://developer.intel.com/design/desguide/index.htm. It is more friendly than a Word download at Microsoft. ■

Paul McGoldrick is an industry consultant based on the West Coast.

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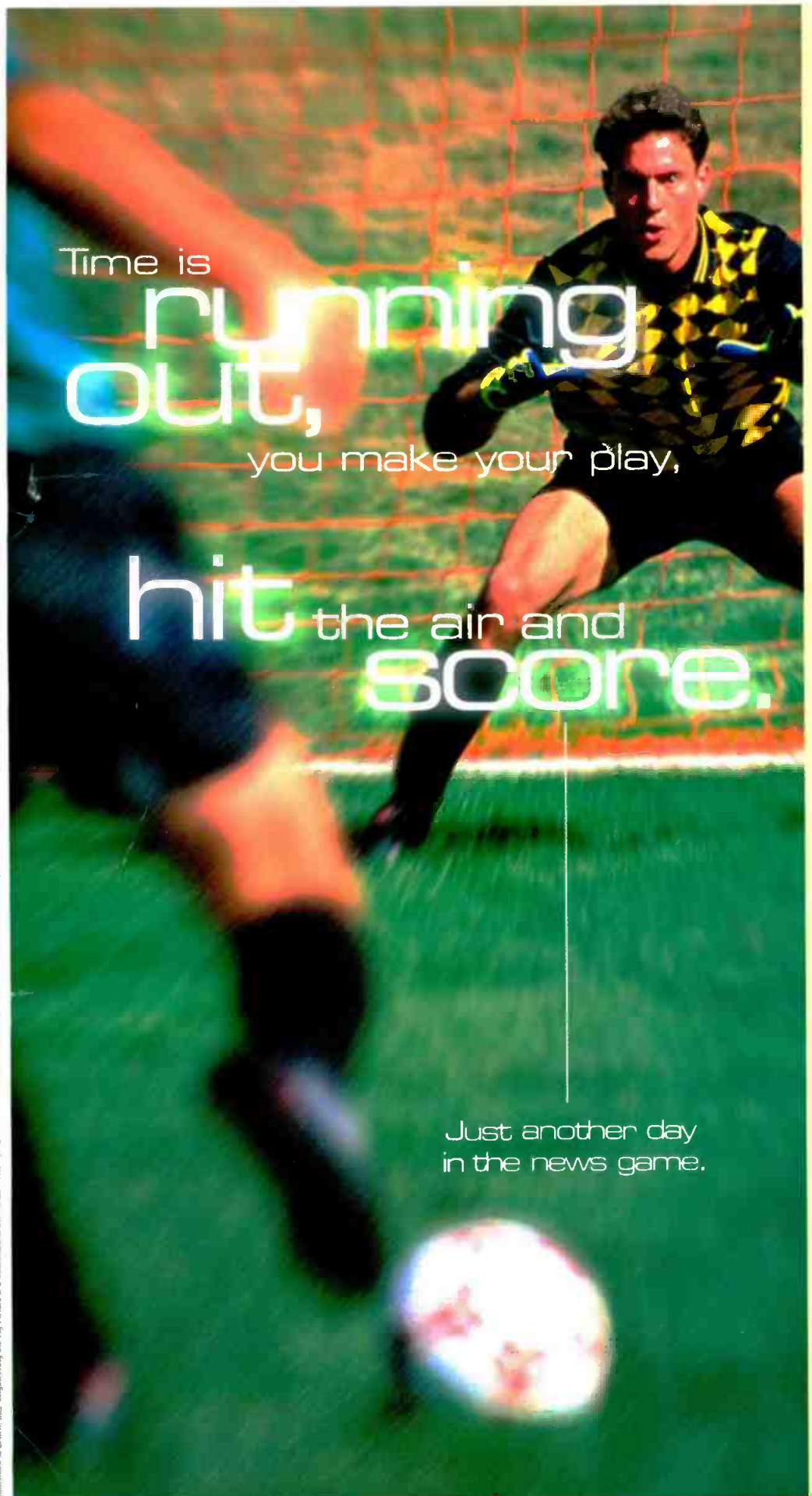

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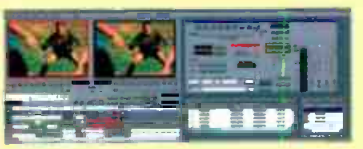

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