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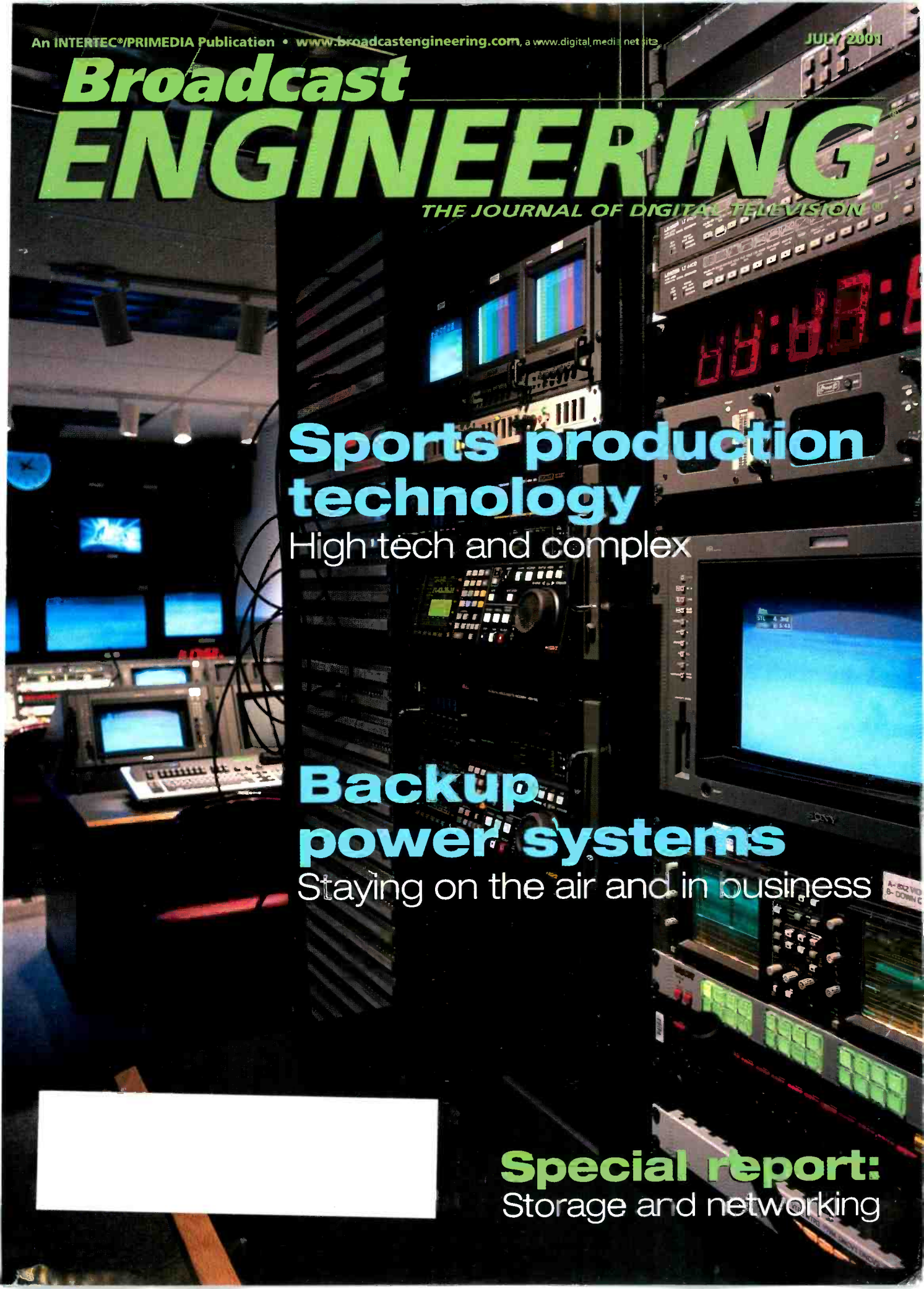
JULY 2001

# Broadcast ENGINEERING

THE JOURNAL OF DIGITAL TELEVISION



## Sports production technology

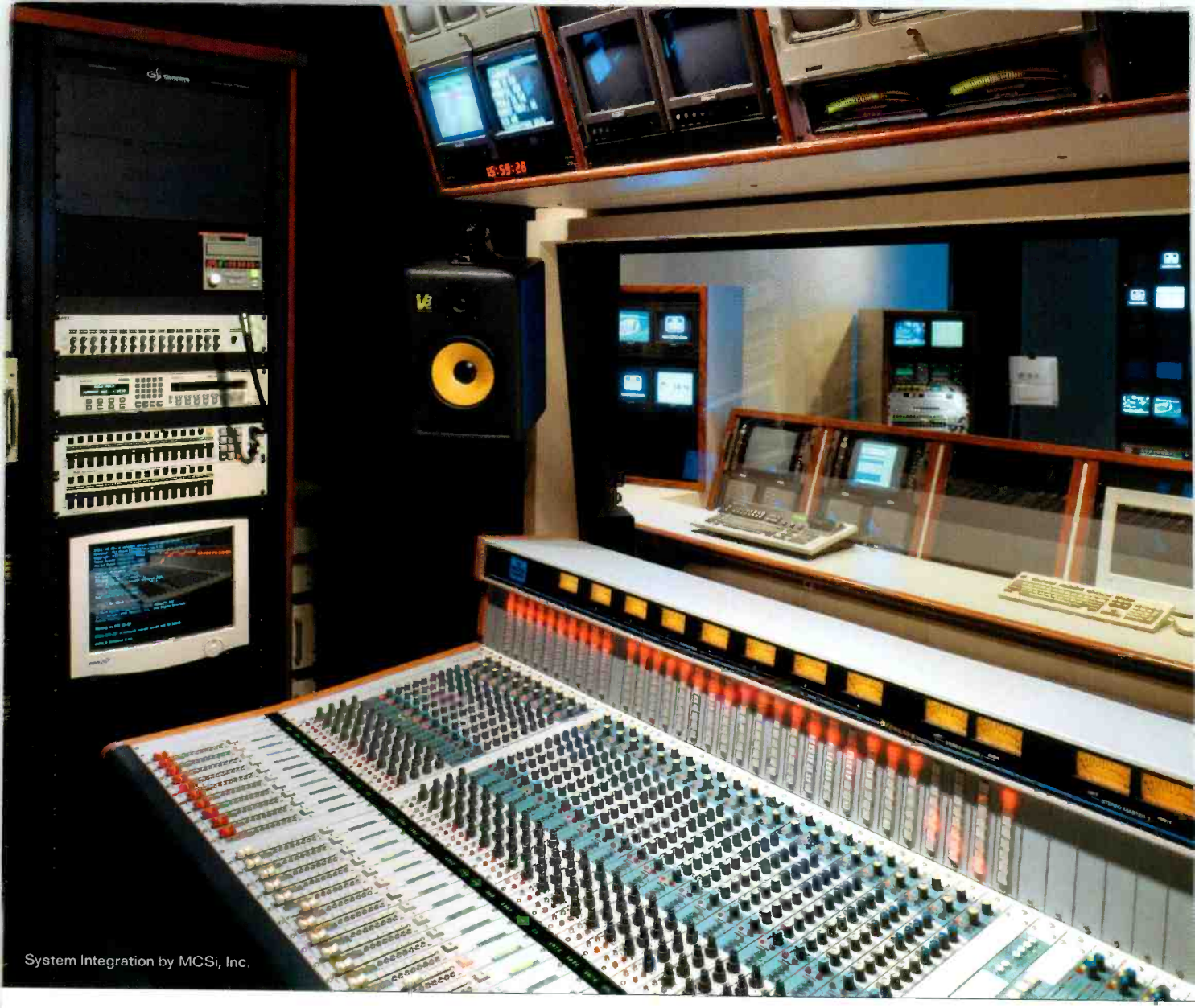
High tech and complex

## Backup power systems

Staying on the air and in business

## Special report:

Storage and networking



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*— John Orr, Mgr., Broadcast Engineering Projects*

"YOU JUST CAN'T GO WRONG with WHEATSTONE. Their boards are intuitive and clean sounding, and you can track signal flow at a glance. In my eyes the greatest feature of the TV-80 is their mix-minus bus system. *Anyone out there who's 'faking' mix-minus by using submasters or an external box will wonder how they did without it.* The TV-80 is a definite time saver, both in installation and operation. It makes audio operators more confident and reduces show prep time—we're now able to do more and better pre-production. Definitely WORTH EVERY PENNY!"

*— Craig Reeves, Audio Engineer*

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KRIV, WFLD, WOIO, KCOP, KGW, WPXI, WCNC, WTVD,

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*Due to contractual agreements, some stations not listed.

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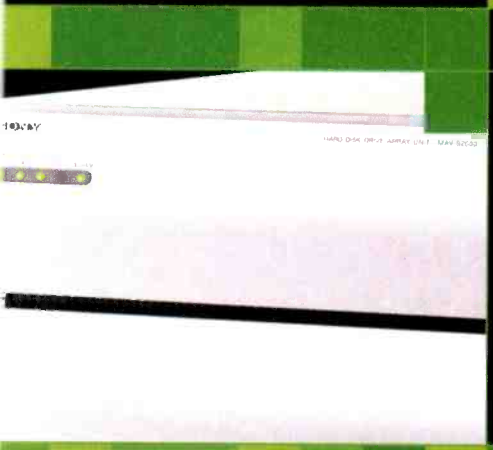


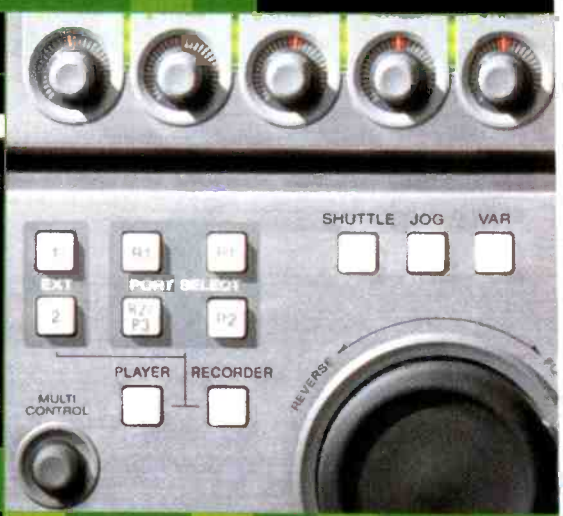


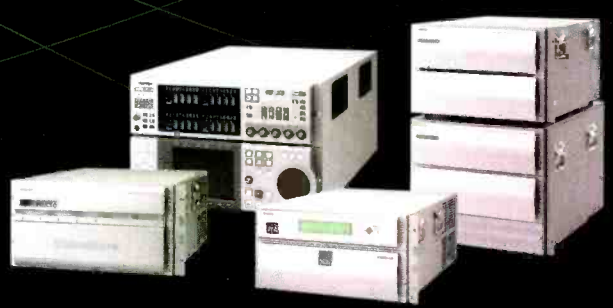

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July 2001
Volume 43
Number 8

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IN THIS ISSUE




# Features



# Beyond the Headlines

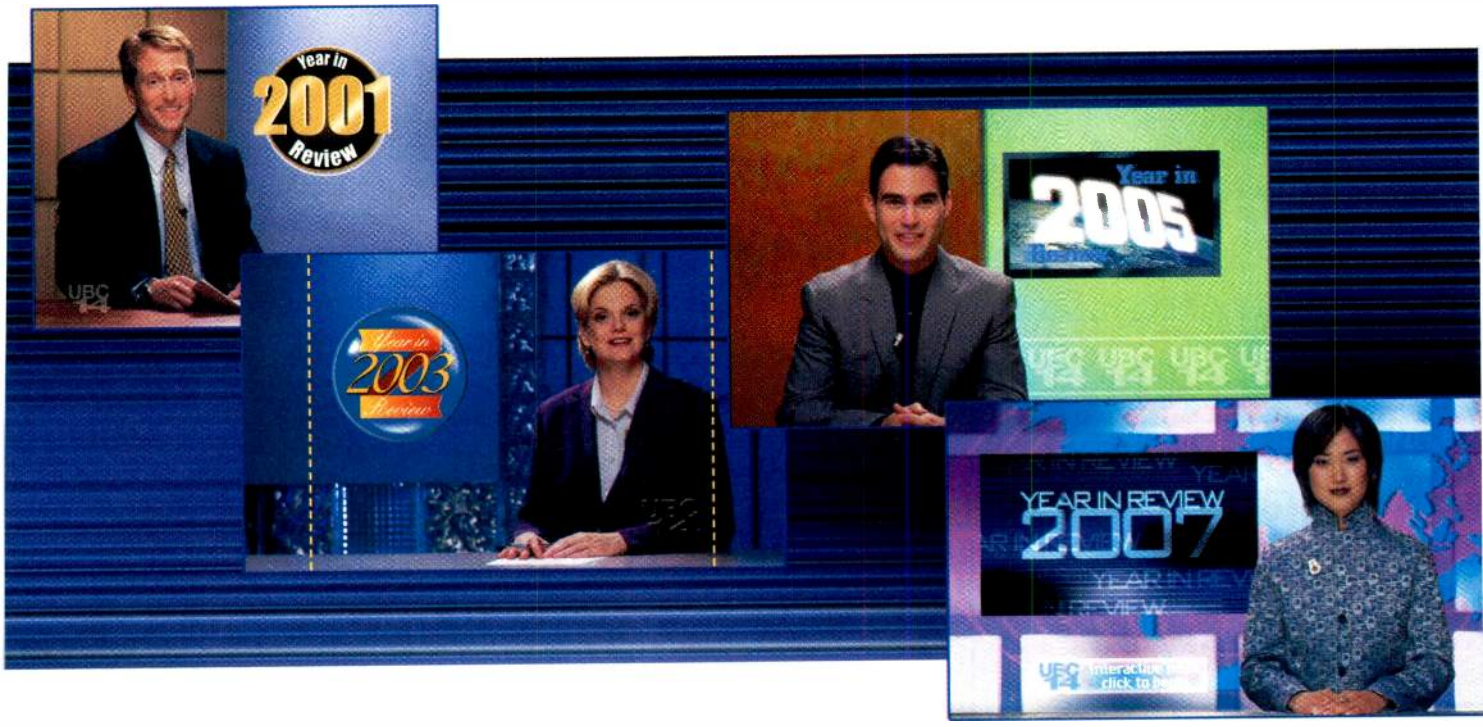


# Digital Handbook



**ON THE COVER:** National Mobile Television and Sony Systems Integration Center designed and built the nation's first serial digital high-definition mobile broadcast units, HD-1 and HD-2, for major sports, entertainment and corporate events. Photos provided courtesy of Sony Systems Solutions Division. Photographers, Concept: Benson and Rice.

*(continued on page 8)*

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# Systems Design & Integration



# New Products & Reviews



# Departments



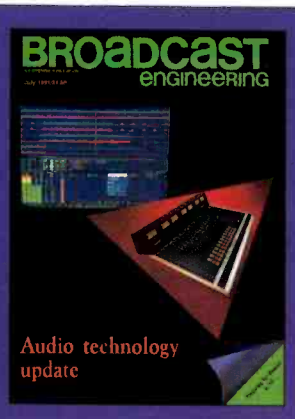


## FREEZE FRAME

A look at the technology that shaped this industry

### What a difference 10 years makes

We're down to one — proposed format, that is. Name the original 10 digital radio formats proposed at the 1991 NAB convention. All correct entries will be eligible for a drawing of the new *Broadcast Engineering* T-shirts. Enter by e-mail. Title your entry 'Freezeframe-July" in the subject field and send it to: editor@intertec.com. Correct answers received by Aug. 1st, 2001 are eligible to win.



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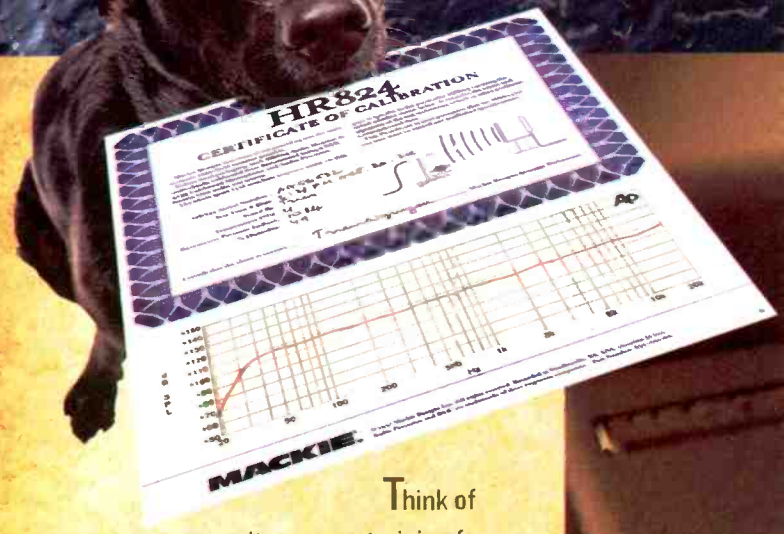


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# Free TV – Part II

Boy, did I have fun with the May "Free TV" editorial. The editorial generated more feedback than any I've written in the past 16 years. In fact, I received more letters from that editorial than the one lambasting 8VSB.

By now, many of you who wrote me have probably figured out, I was really talking about an off-the-air antenna. The truth is, yes Virginia, there really is free TV. It's out there in the sky above your house, and even in your basement if you want it. The problem is that most folks don't know about it. They continue to believe that nothing is free anymore — even television programs.

It's a sign of today's society. You go to the gas station and pay for free air. You pay the phone company extra just to not list your phone number. And we're all still paying an extra fee for "Touch-tone." What scams.


Based on the tremendous feedback to my earlier Free TV editorial, I suggest we take back the free airways. Let's launch a national campaign promoting Free TV. We'll get some celebrities to hawk the advantages of Free TV. They can claim they've made the switch and lost weight, cured their acne or broken that evil cable TV habit.

For example, we'll get Bob Dole. "I erected my own TV tower to get Free TV," he'll say. To catch the younger crowd, Jennifer Lopez, in some skimpy outfit standing next to a TV with one of her videos playing. She'll say, "With the money I save with Free TV, I can get an extra pedicure every month." Or how about James Earl Jones, in his deep, Darth Vader voice, slowly saying, "Get Free TV now, or the Force will destroy your set."

Don't forget the politicians. First would be former president Bill Clinton. "Why, I'd give two nights in the Lincoln bedroom for my Free TV," he'd say. Everybody likes to get a bonus, so we'll have Vice President Dick Cheney saying, "Get your Free TV now and I'll throw in 10 free gallons of gas." Then we'll boil the reasons to get Free TV into something simple.

Top 10 reasons to get drop cable and get Free TV:

10. It doesn't cause cancer.
9. The antenna towers will invite lighting strikes at your mother-in-law's house.
8. No messy cable boxes and multiple remotes to fool with.
7. Your kids can't watch MTV anymore.
6. No more animal rights channels.
5. No more trying to convince your wife that all those VOD movies you ordered were really nature videos.
4. Without 500 channels, your kids will go to their friends' homes to watch TV.
3. If you're convicted of anything, you can claim it was because you were deprived of cable.
2. At least you'll know you aren't paying for all those lousy programs.

And the number one reason to have Free TV — It'll really piss off the cable companies.

Brad Dick

Brad Dick, editor

**Send comments to:**
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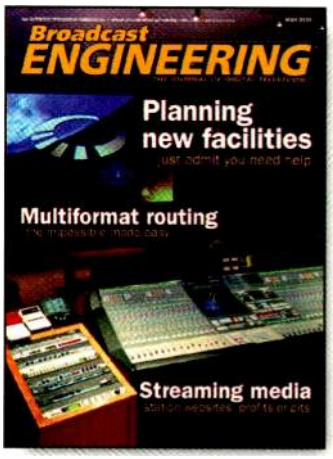
# Reader Feedback




## McGoldrick strikes a chord with women

Dear sir:

I just had a few comments regarding your May article, "Where are the women?"

Oh, we're out there, it's just that you need a magnifying glass to see us.

I was blessed with parents that didn't scold me when I took apart all the phones and alarm clocks in the house when I was 12. They helped me to see that it was all part of the learning process. I agree with Mr. McGoldrick, when he stated, "As a body, engineers should take blame for not getting out there to be proactive in promulgating ourselves." I have found that here in the United States, we seem to lack the motivation to help those young women interested in the electronics to be aware of the various options available to them. Here's where we could learn more from our neighbors. In Canada, they have mentoring programs and summer internships for young women of all ages. The Women's Television Network and the WTN Foundation run television technology programs for women and girls in Canada.

Believe me, I knew going into this profession that being taken seriously would be the biggest challenge, but I'm like most female engineers — we love challenges. I've learned, over the years, (and I'm still in my 30s) that patience and humor are virtues that get me through all the scrutinizing, insensitive comments and prejudice that comes from my male co-workers. Even now, as I re-enter the broadcast engineering field after pursuing my own business ... I have found that I need to work at lesser jobs to prove my skills and abilities once again before being welcomed into the inner circle. Thanks for the article.

Sincerely,

NANCY NAPOLI-PEDRICK, WPHL-TV

To Mr. McGoldrick:

As a female Engineer for Dome Productions Inc. In Toronto, Canada, I agree somewhat with your article about how few female engineers there are in the work force. Speaking from personal experience, after two years of being in this field I still find myself competing with other male co-workers for the same respect. Heck, a few of the operators I work with still think I'm a Utility or a TVA. I grit my teeth and explain, "Yes, I am an engineer." I may not be as experienced as some of my co-workers at this moment in my career; however, I am a hard worker, eager to learn and I deserve the respect and the trust of my colleagues.

Maybe there is lack of women in this field because, let's face it, it is not the most glamorous of jobs. It is a dirty job and maybe many women are not willing to commit to a profession that may take them away from their family life to a certain extent. Some weeks I put in up to 30 hours of overtime. If I were raising a child this would certainly become a problem. Maybe a lot of women hold a typical 9-to-5 job in order to have similar schedules as their children.

JAIMIE SWAIN

Another letter:

I just got done reading your article about "Where are all the women?" and I must say that I had a bit of a reaction. As a woman who has spent the last 17 years as a broadcast engineer, I've also noticed that not many women have chosen the field of electronics ... but I don't think it's because girls in middle school start thinking of math as a "boy-geek" thing. As an advanced placement math student, I can recall perfectly the time at which it became socially un-cool to be good at math ... boys made it perfectly clear that girls who were good at math and science were not as attractive and therefore not as socially desirable — it was clearly threatening to their impending masculinity. Many girls I knew decided they didn't want to be smart if it meant they couldn't get a date, and so many girls decided to take languages, or social science, or creative writing, where it was okay for them to succeed.

I think things are a bit better today, as there are a lot of studies that have been done about this phenomenon in girls' development, and male/female roles are somewhat less narrowly defined that in past decades. But I think that educators in our middle and high schools, parents and engineers need to make a concerted effort to educate our kids about the myriad of possibilities that are available to us as individuals, and to encourage values that reflect diversity in the workplace.

My eight-year-old daughter knows that if she needs something fixed, she can call me — but she also most times will try to take it apart herself. We need to expose our kids to women doing all kinds of work, so that it doesn't seem strange or unusual. And we need to enlist women interns to do a stint in the engineering department— not just production.

And of course, we need to remind our daughters that if they want to support themselves, they need to find jobs that will compensate them sufficiently. That was the only reason I joined the profession.

LORI TENNENHOUSE
ASSISTANT CHIEF ENGINEER, WXMI-TV

# THE ESSENTIAL DIGITAL AUDIO ANALYZER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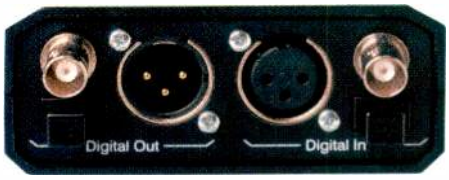


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News

# Power shifts in Washington

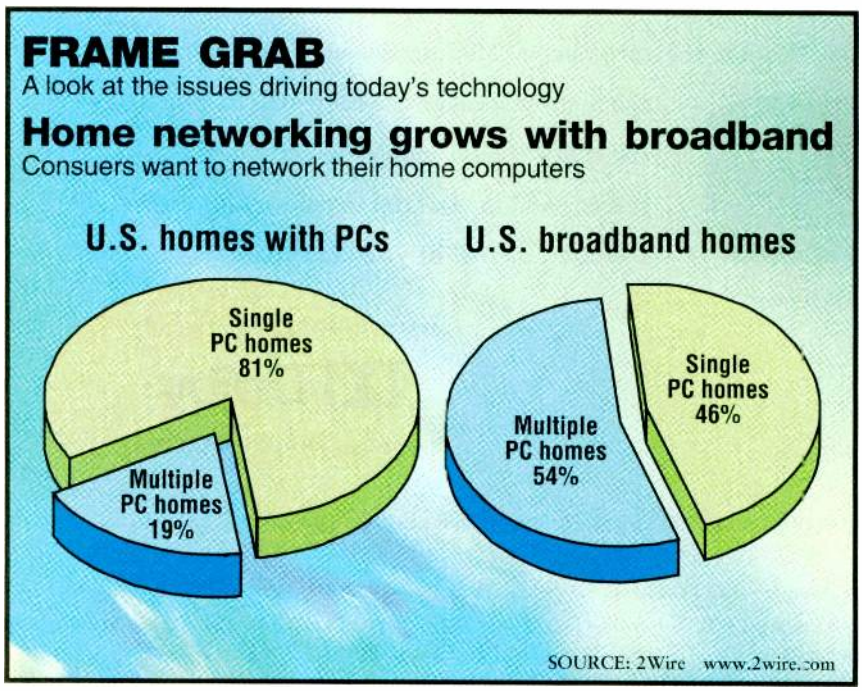
BY LARRY BLOOMFIELD

The old saying is that only two things are for certain, "death and taxes." To this, should be added "change." The latter is probably truer than the former. This is particularly applicable to the political environment in Washington, D.C.

The recent political balance in Washington was so precarious that the change of one Senator's political allegiances has caused a complete shift in the way business will be conducted and what can be expected out of the nation's capitol. Chairmanships of virtually all senatorial committees have changed hands to what is now the majority party in that house of Congress.

Of particular interest to broadcasters is the shift in chairmanship in the Commerce Committee from Senator John McCain (R-AZ) to Senator Fritz Hollings (D-SC). With this change, we can expect a significant change in many areas, including but not limited to TV ownership caps, newspaper-broadcast cross ownership, deregulation of nearly all parts of the communications industry, TV violence issues and the transition to digital television.

One of the major reasons Fox CBS and NBC left the National Association of Broadcasters' fold was over NAB's stand on ownership caps. There was a ray of hope for the cap to rise under the old guard, but it is unlikely under the current leadership. Cross ownership had a chance, but is nearly a dead issue now. Telco's expansion into broadband service might have gotten off the ground, but is also nearly a dead issue. As for the transition to digital, the old guard would have held broadcasters to a tight transition schedule, but that may well be eased under the new leadership, with sources saying that this might include a push for more HDTV content as one approach to acting more in the public interest. With a 60 percent change in the top echelon at the FCC, it should prove to be an interesting ride.




Not only is there a whole new twist in Congress, but we've also got a whole new team leading us down the communications regulatory path at the FCC. This spring saw three new faces: Kathleen Abernathy, a Republican, was vice president for public policy at communications service provider BroadBand Office Communications; Michael Copps, a Democrat, was an aide to Sen. Ernest Hollings, D-MN (not to be confused with Senator Fritz Hollings [D-SC]), the new Senate Commerce Committee boss; and Kevin Martin, a Republican, was recently a deputy general counsel for George W. Bush's presidential campaign and a former FCC aide. All are attorneys.

Chairman Michael Powell had his term with the Commission renewed. Commissioner Tristani's (a Democrat) term should last another year. The FCC is directed by five Commissioners appointed by the President and confirmed by the Senate for five-year terms, except when filling an unexpired term. The President designates one of the Commissioners to serve as Chairperson. Only three Commissioners may be members of the same political party. None of them can have a financial interest in any Commission-related business.

The FCC officials recently asked for public input on reorganizing the agency. The project is being led by Mary Beth Richards, an FCC Special Counsel who plans to unveil a reform plan later this year. It is expected that the FCC's industry-specific bureaus, such as Mass Media, Wireless and Common Carrier, will be realigned along functional duties such as licensing, enforcement and consumer affairs. No specific due date for comments was posted, but FCC officials say they will be collected soon. ■

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# PSIP testing

Do you know for sure if your DTV transport stream is performing the way it should? If it isn't, it can cause all kinds of problems. Not all stations have the budget for a cache of equipment to test and analyze every nuance of their transport stream. The same is true of measuring your frequency. Most stations have a service that does that, so why not a service that checks your station for transport stream errors and compliance?

Probably the biggest transport stream issue is with PSIP. (For a complete tutorial on PSIP, see *BE* June, p.140.) PSIP has gotten off to a rocky start, but if implemented properly at the television station and addressed in the digital television receiver, it's a valuable tool.

Although PSIP may contain a station's program guide, that's only a small part of what it can do. Art Allison, director of advanced engineering for the NAB, uses a cake as an analogy: "In NTSC we send the entire finished cake, but with PSIP, we send a digital recipe, along with the ingredients and then give the DTV receiver the directions on how to bake it. In addition to this, there are capabilities for branding of virtual channels. Here's a case where the engineers provide the tools and then get out of the way and let the marketing folks use them as they see fit,"

Unfortunately it hasn't gone all that smoothly. The ATSC has a complete set of specifications for PSIP and transport stream compliance. The FCC does not require stations to use PSIP, so some digital stations have chosen not to implement it as part of their DTV transition. But what if you have PSIP and it or any other part of your transport stream isn't error free?

If a set is expecting to get the PSIP information and the station isn't sending it or isn't sending an error-free transport stream, you can rest assured, no matter how good the received signal is, it isn't going to get past the decoder and there will be no picture. Some early DTV sets didn't make accommodations for PSIP, so what happens to those stations that want to do multicasting? The sets don't know what to do with the additional information and, again, probably no picture. The bottom line is that there is nothing wrong with PSIP or the other ATSC standards, if they're implemented properly.

As the result of field tests done from Nov. 1, 2000, through April 30, 2001, Triveni Digital found that many DTV transport streams do not comply with the ATSC standards, confirming the suspicion that equipment problems and/or configuration errors abound. This accounts for many of the tuning problems with digital television receivers, among other problems.

The company's technology permits the DTV stream tests to be recorded either by a DTV station, system integrator or the employees of Triveni Digital itself.

When station personnel record their own transport streams, the data is stored on commonly available digital media such as a CD, Zip disk or Org disk and then sent to Triveni for analysis. The typical duration for recorded streams ranges from 60 to 65 seconds (approximately 150MB) of transport stream sampling.

Once the tests had been conducted, the findings are analyzed for compliance with ATSC standards. The net result of all this testing and analyzing is a confidential report delivered to the client DTV station or system integrator informing them of any problems.

The test focuses primarily on the following areas:

- ATSC Program and System Information Protocol (PSIP) standard (A/65): PSIP problems can interfere with DTV receivers tuning to channels or displaying them in electronic program guides.
- Audio and video buffer usage: Buffer underflow or overflow can cause audio or video to break up or be presented with incorrect synchronization (lip sync issues).
- Program Clock Reference (PCR) frequency and jitter: PCR problems can cause synchronization problems with video and audio. In extreme

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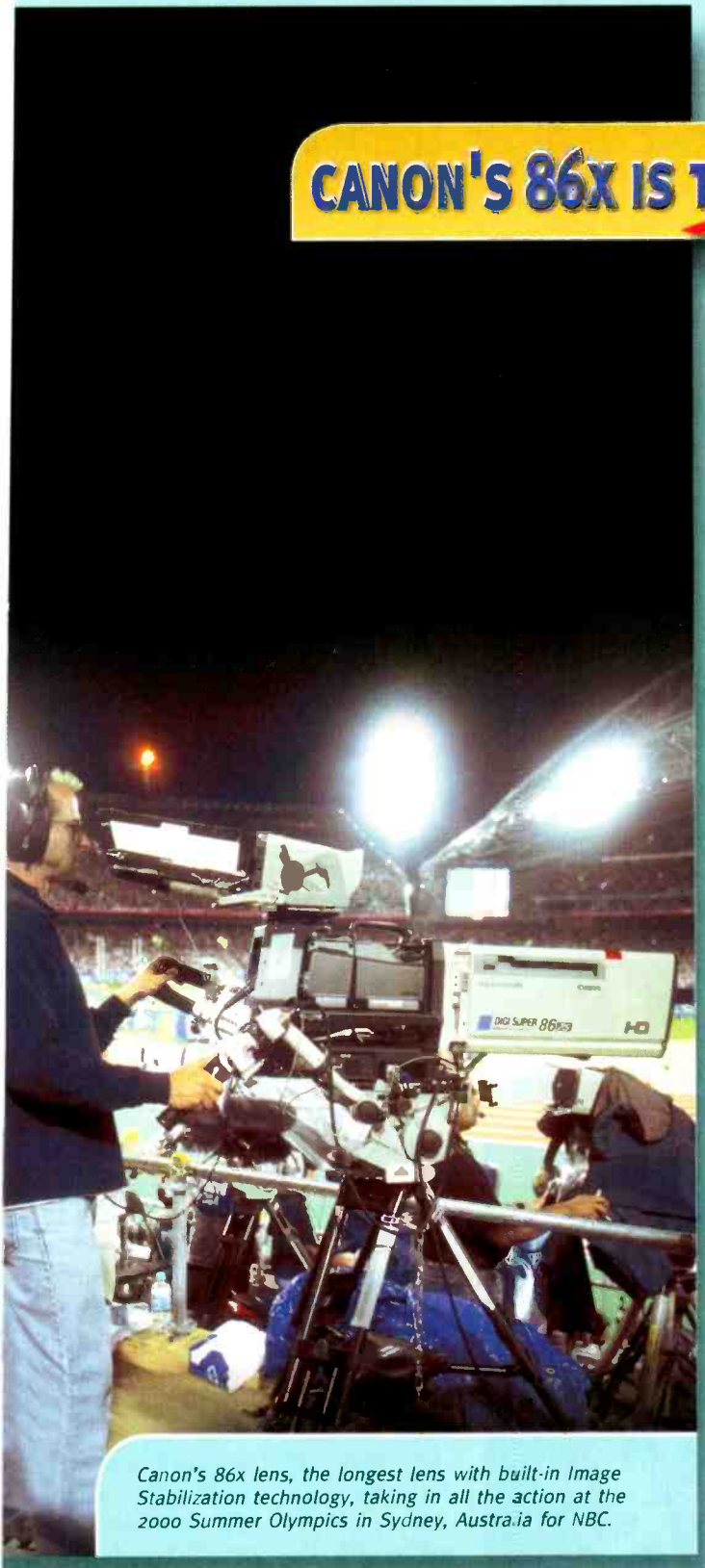

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| Missing PSIP tables or syntax errors | Receivers may not be able to navigate or access EPG | 39% |
| No EITs/Blank EITs | Blank lines in EPG for that channel | 35% |
| PCR jitters and frequency deviation | Receivers may not be able to synchronize with encoders | 17% |
| No PSIP metadata | Receivers may not be able to navigate, access EPG, update the clock, etc | 13% |
| Video buffer usage | Degraded video quality or lip sync problem | 9% |

cases they may even result in glitches in the audio or video due to lost data.

Table 1 tells a revealing story and summarizes tests taken of 23 streams at 21 different DTV stations over the test period mentioned earlier.

DTV stations may have some degree of these problem errors and don't even know it. A simple test, similar to that performed by Triveni, could put this question to rest.

For additional information, visit Triveni Digital's website: www.TriveniDigital.com ■



## Display on display

This year's Society for Information Display (SID) convention was a showcase for makers of display devices of every ilk. Exhibitors at SID are the people who build display devices, not the whole monitor or TV set.

With the public reluctant to pay much for DTV and HDTV receivers, SID was a good place to look for technological trends that could cut the costs of delivering quality pictures to American homes.

The different types of displays can be broken down into three major categories: transmissive, reflective and emissive.

Although all these display devices achieve the end result of producing a viewable picture, it is important to note there are distinct differences. The transmissive display, for example, modulates a light source similar to the displays used on today's laptop computers. The reflective display device uses a mirrored surface that reflects light out to the viewer similar to the digital micro-mirror device (DMD) and the emissive display is a flat-panel display that uses electrical excitation of chemicals, such as the organic light-emitting diode (OLED).

Of particular interest in the transmissive display family was a device shown by IBM called "Bertha." Bertha offers

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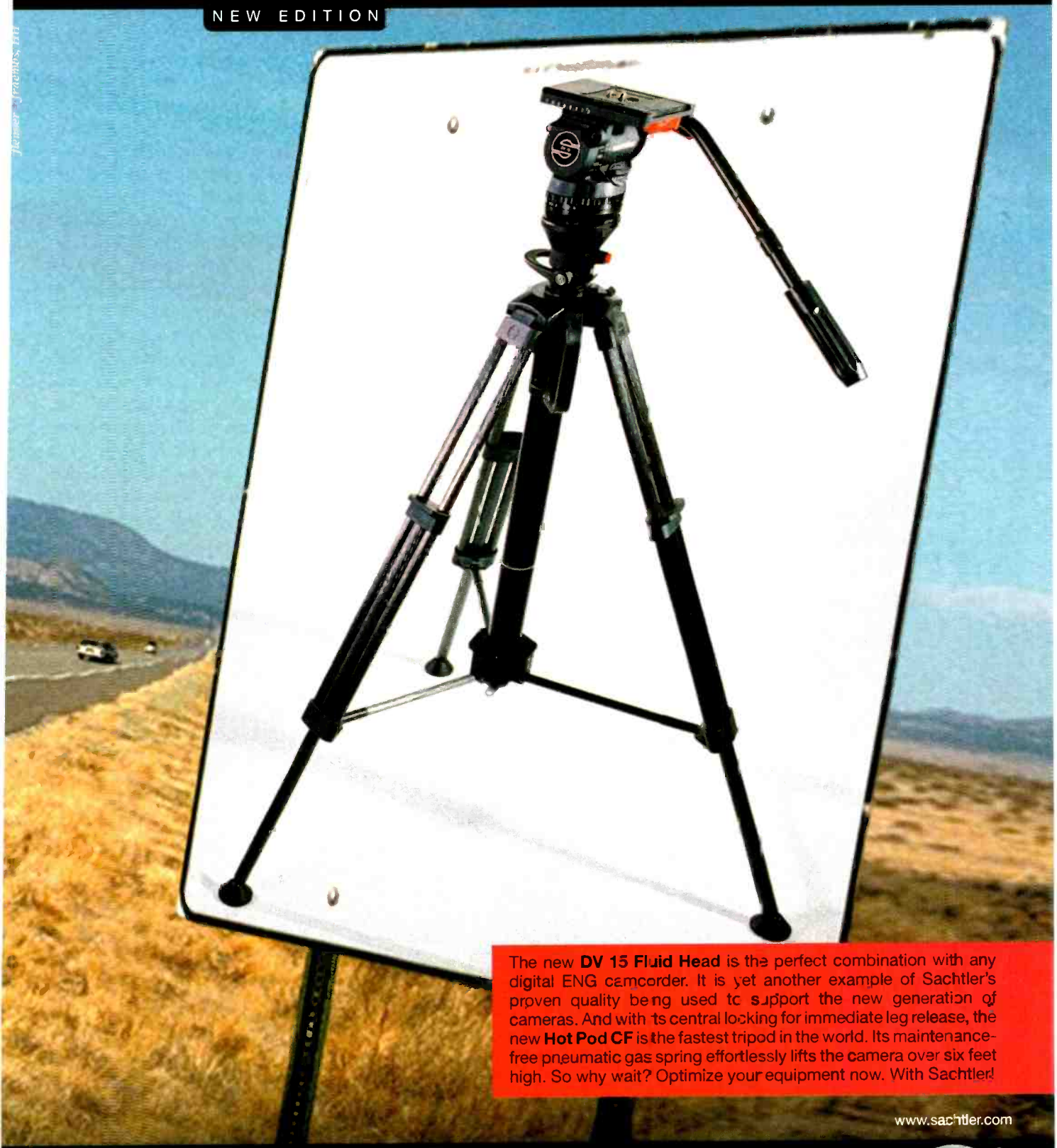

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"Bertha," from IBM, is about 12 times sharper than any display device currently on the market.

an extremely high pixel density (204 pixels per inch) and pixel count, or format (3840x2400), which works out to a display of more than nine million pixels. In other words, Bertha has about twice the linear pixel density (204ppi) of typical displays in the marketplace today (approx. 100ppi) or four times the area density.

The monitor has a 16x10 aspect ratio and measure only 22 inches diagonally. This equates to slightly more than four complete HDTV pictures at 1920x1080 pixels each, all on one screen, plus room for a taskbar at the top or bottom. To make this even more remarkable, IBM provided attendees with a magnifying glass and it was still difficult to see the individual pixels up close.

The only current disadvantage to Bertha is that if the data format presented to the display is smaller or larger than the native format, then some sort of scaling has to be done.

In the reflective family, Direct Image Light Amplifier (D-ILA) or Hologram Projection Television, an active-matrix lighting crystal display, had a presence. This technology uses a white light source through diachronic mirrors, where it splits into red, blue and green (RGB), is modulated, and is then projected onto a screen.

An impressive entry came from Displaytech, whose ferro-electric liquid crystal display (fLCD) is a completely digital display device, somewhat similar to the DMD, except that the fLCD has no moving parts and the cost is significantly less to manufacture. Instead of being micromechanical, as with the DMD, the fLCD is a miniature liquid crystal display that reflects light.

fLCD-based display devices could be on the market this fall. That monitor will have three fLCDs controlling each of the RGB components of a picture.

Among emissive devices, several companies showed their version of an organic light-emitting diode (OLED). These devices can best be compared to a firefly, only much brighter and faster. Because they don't need an external light source, they tend to be much more efficient. Currently OLEDs are manufactured on glass substrates, but it is possible to "print" them onto a flexible material such as Mylar, also making them significantly less fragile. ■

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FCC Update

# Class A TV rule refined

BY HARRY C. MARTIN

The Commission has clarified and modified the programming and technical aspects of its newly created Class A television service.

*Must-carry.* The Commission clarified that Class A stations have the same limited mandatory carriage rights on area cable and satellite systems as LPTV stations. Although petitioners had requested that the Commission grant Class A stations the same full must-carry rights that are afforded to TV broadcast systems, the Commission said that it could not grant those rights without approval from Congress. The decision was not surprising in light of the recent order implementing the Satellite Home Viewer Protection Act of 1999, in which the agency concluded that Class A stations are low-power stations for mandatory carriage purposes and are therefore not entitled to mandatory satellite carriage.

*Offsets.* In another significant move, the Commission modified its rule permitting Class A stations to operate without a carrier frequency offset. In response to a request filed by Fletcher, Heald & Hildreth, the Commission determined that mandatory offset operations would allow for more efficient use of broadcast spectrum by making room for more new LPTV or Class A stations and/or by allowing more existing stations to increase facilities. Under the new rule, all Class A station licensees must operate with a carrier offset by Jan. 13, 2002. Between now and then, all Class A construction permits and pending applications for such permits must be amended to specify a carrier offset. The Commission reserves the right to direct any Class A station licensee, permittee or Class A-eligible LPTV applicant to immediately operate its station with a carrier offset at the request of a displaced Class A station, displaced Class A-eligible LPTV station, or applicant or allotment petitioner for a new NTSC television station. This new rule will generally not apply to television translator and non-Class A LPTV stations.

*Local programming.* The Commission also redefined local programming under its Class A rules. The amount of local programming a station broadcasts determines if that station is eligible for Class A status. However, the Commission's initial rule could be read to mean that any programming produced within the Grade B contour of any commonly controlled station could be considered local, even if that station were distant from the station airing the programming. That was not the Commission's intent. The new, clearer definition of local programming covers material produced within the predicted Grade B contour of the station broadcasting the program or produced at the station's main studio. Multiple commonly controlled Class A stations may consider programming local if it is produced within the predicted Grade B contour of any physically contiguous commonly controlled station. Also, the main studio for a group of commonly controlled and contiguous stations can be within the contour of any of those stations.

## Dateline

July 10, 2001, is the deadline for all stations to place in their public files their problems/programs lists and quarterly Forms 398 (Children's Programming Report) for April 1 to June 30. Stations in the following states must file their biennial ownership reports by Aug. 1: California, Illinois, North Carolina, South Carolina and Wisconsin.

## Dual-network rule relaxed

The Commission has amended the dual-network rule to allow common ownership of one of the four major networks (ABC, CBS, FOX and NBC) and one of the emerging television networks (WBTN and UPN). The rule change accommodates Viacom's ownership of CBS and its pre-existing stake in UPN. According to the Commission, the growth of cable television networks, direct broadcast satellite services and the deployment of digital television negates concerns about any negative impact the repeal would have on competition and diversity.

## DTV dateline

Commercial stations with DTV authorizations must complete construction by May 1, 2002 and, for noncommercial (NCE-TV) stations, the deadline is May 1, 2003. The Commission will grant extensions of these deadlines where construction has been prevented due to causes beyond the licensee's control (e.g., weather or zoning problems, unavailability of tower space, unavoidable construction delays). Extensions are granted for six months only, although the Mass Media Bureau is permitted to approve one renewal.

Commercial stations with authorizations that do not make full use of their DTV allocations nevertheless will be protected from interference on the basis of their allocations until Dec. 31, 2004. The date for NCE-TV is Dec. 31, 2005. Thereafter, only the granted authorization (license) will be protected.

On or before Dec. 31, 2003 (Dec. 31, 2004, for NCE-TV), stations with both their NTSC and DTV channels in the core (Channel 2 – 51) will have to elect whether to use their existing NTSC channel or their DTV channel for DTV. Actual implementation of the election may be delayed until the final turn-off date for one channel or the other. ■

*Harry C. Martin is an attorney with Fletcher, Heald & Hildreth PLC, Arlington, VA.*

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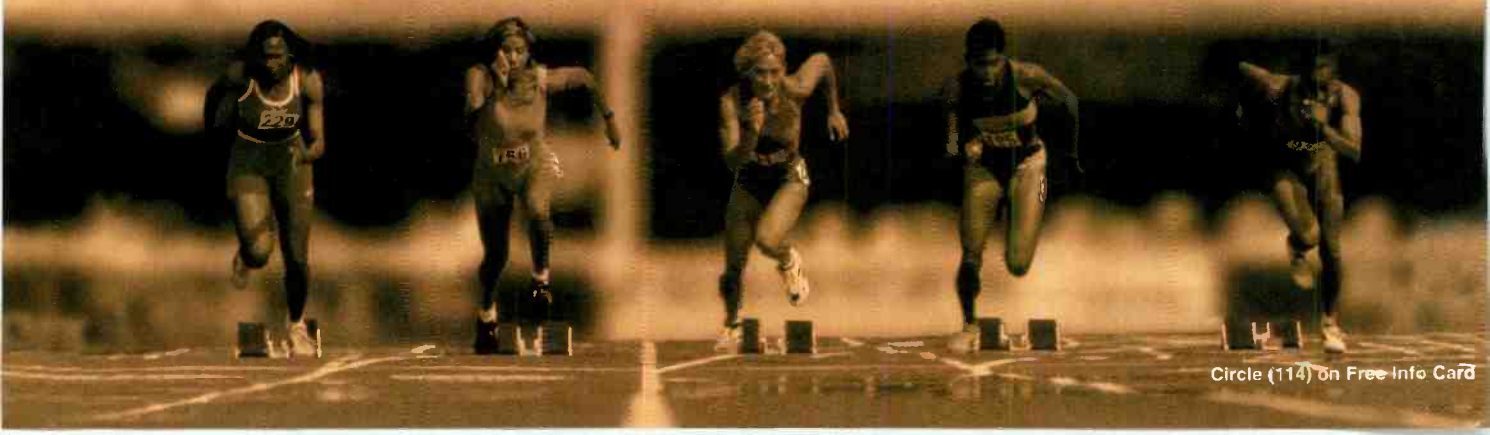

# New features for STBs and receivers

**BY MARK MASSEL**

Digital set-top boxes (STB) are available for cable, terrestrial and satellite broadcast media throughout the world. Virtually all of these systems incorporate a single tuner to select a particular channel or bouquet of programs of interest. The transport stream is then demultiplexed to allow viewers to select only one program to be displayed on the TV. The digital transport stream is very important to the STB and to some of the new features that will come in the future.

## The digital transport stream

The main purpose of a transport stream is to ease the implementation of the forward error correction (FEC) system. The transport stream is the bitstream that carries all of the programming data. (See Figure 1.)

It has been defined in such a way as to minimize the processing effort required at a receiver when retreiving the coded program data.

Each program will consist of various items, typically video, audio in various languages and teletext. These programs are constructed out of what are known as elementary streams (ES), compressed datastreams bundled together with a common time reference — the program clock reference (PCR). In order for the ESs to be transmitted down the same channel they must be split up into small sections. These sections are called the transport packets (TP). These TPs are then multiplexed together to produce one bitstream — the transport stream (TS).

The packet is split into a header and a payload. The payload contains the PES and the program-specific information (PSI).

**The main purpose of a transport stream is to ease the implementation of the FEC system.**

Demultiplexing is the process of extracting all of the useful information from the transport stream. The demux process must construct the program association table (PAT), the program map table (PMT), the network information table (NIT) and the conditional access table (CAT). It also must extract the compressed video data, audio data and any other data required from the transport stream for a particular video channel.

## Chip level

At the heart of any STB is a single chip, known generally either as the central or demux processor. (See Figure 2.)

However with the technological advances in silicon from the semiconductor manufacturers it becomes easier and easier to integrate more and more features onto the same chip at virtually no extra cost. Already integrated in the demux processor are functions like tuner interface and control, SDRAM and FLASH memory interfaces, MPEG-2 decoding, Electronic Program Guide (EPG) graphics, smart card interfaces, IR remote and front panel control, audio and video signal processing and generation, etc.

## New features

DSPs for advanced audio processing are being integrated; this means theater audio features such as Dolby Digital and SRS TruSurround. This is already a *defacto* mandatory requirement on DVD players, but also will be introduced into more STBs. ATAPI interfaces are being integrated for the easy connection of hard disk drives (HDD) and DVD ROM drives. Additional transport stream input blocks are being added and the inclusion of MPEG-2 encoders will soon be a reality. On top of all this the core processor speeds are increasing, bringing Internet browser functionality on the same chip within the realm of possibility.

## Immediate STB advantages

What does all this mean to the viewer at home? Let's first consider the addition of an HDD with multiple transport stream input blocks. This would allow for simultaneous viewing and recording. In fact STMicroelectronics is developing a demux chip with three demux engines to allow viewers, for example, to view one program with time shift capability while at the same

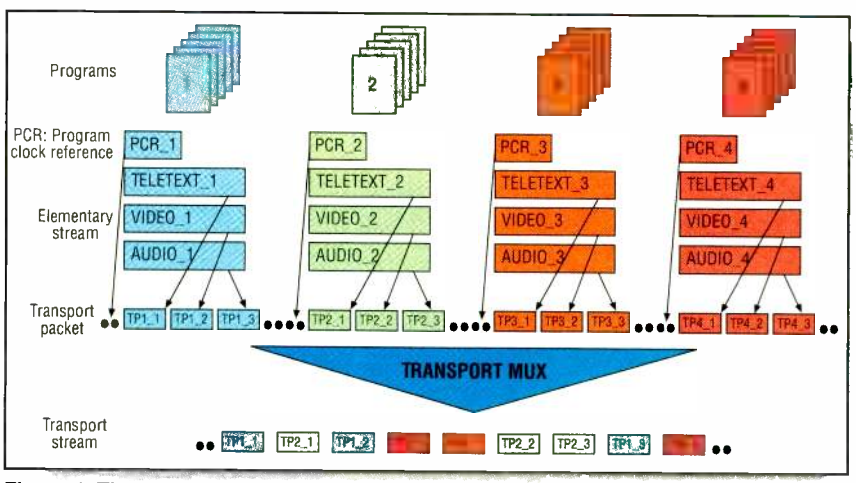


**Figure 1. The transport stream.**

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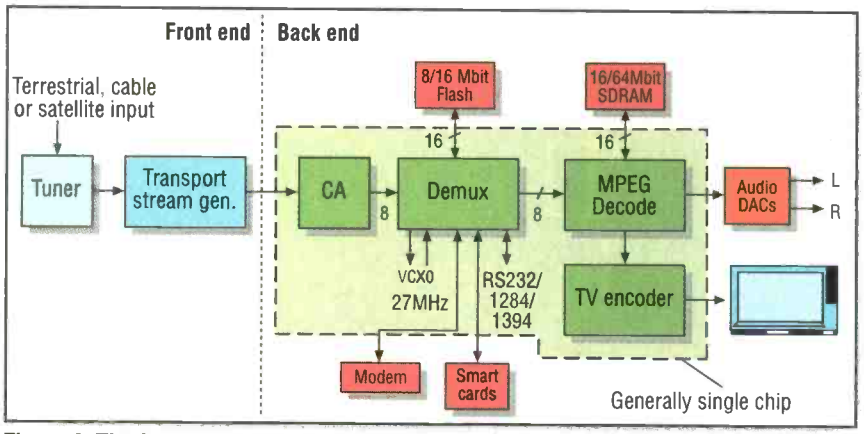


**Figure 2. The functional diagram of a typical satellite STB.**

time recording a completely different program from another input. The demuxing is therefore performed on two transport stream inputs from the tuners, and one from the HDD. By storing the PES to disk and then watching the movie by decoding this disk information it is possible to take a break, then carry on viewing the movie when ready, skip the commercials by fast forwarding or skipping past them, or go back and see a piece of the movie again, even in slow motion.

## Technology convergence advantages

As a general trend, and for product differentiation reasons, more features are being "bundled" in with the standard STB features of today. Broadband Internet is being made available for cable systems. Such features as DVD, CD-DA, MP3 and VCD functionality also can be easily integrated. The DVD data is simply stored in PES format; it has different error correction and decryption requirements and also needs some navigation software. However STBs have already been developed today with no additional silicon being needed on the main processing board. The digital audio features will allow for impressive theater sound effects. The STB can then be connected via an SPDIF output to a home audio amplifier system. Although, with the advances in digital audio amplification devices, the six channel amplification stages can also be integrated into the STB, as has already been done with some DVD players today.

HD STBs also will become more readily available as HDTV transmissions become more common. This should happen first in the United States, although the terrestrial transmission standards may delay things further. The better graphics and higher processor speed of STB technology will make Internet and games applications possible, however this won't become popular until many more home TVs are HD. ■

*Mark Massel works for STMicroelectronics in technical marketing and is author of "Digital television, DVB-T COFDM and ATSC 8-VSB," available either at www.digitalTVbooks.com or from Amazon.com.*

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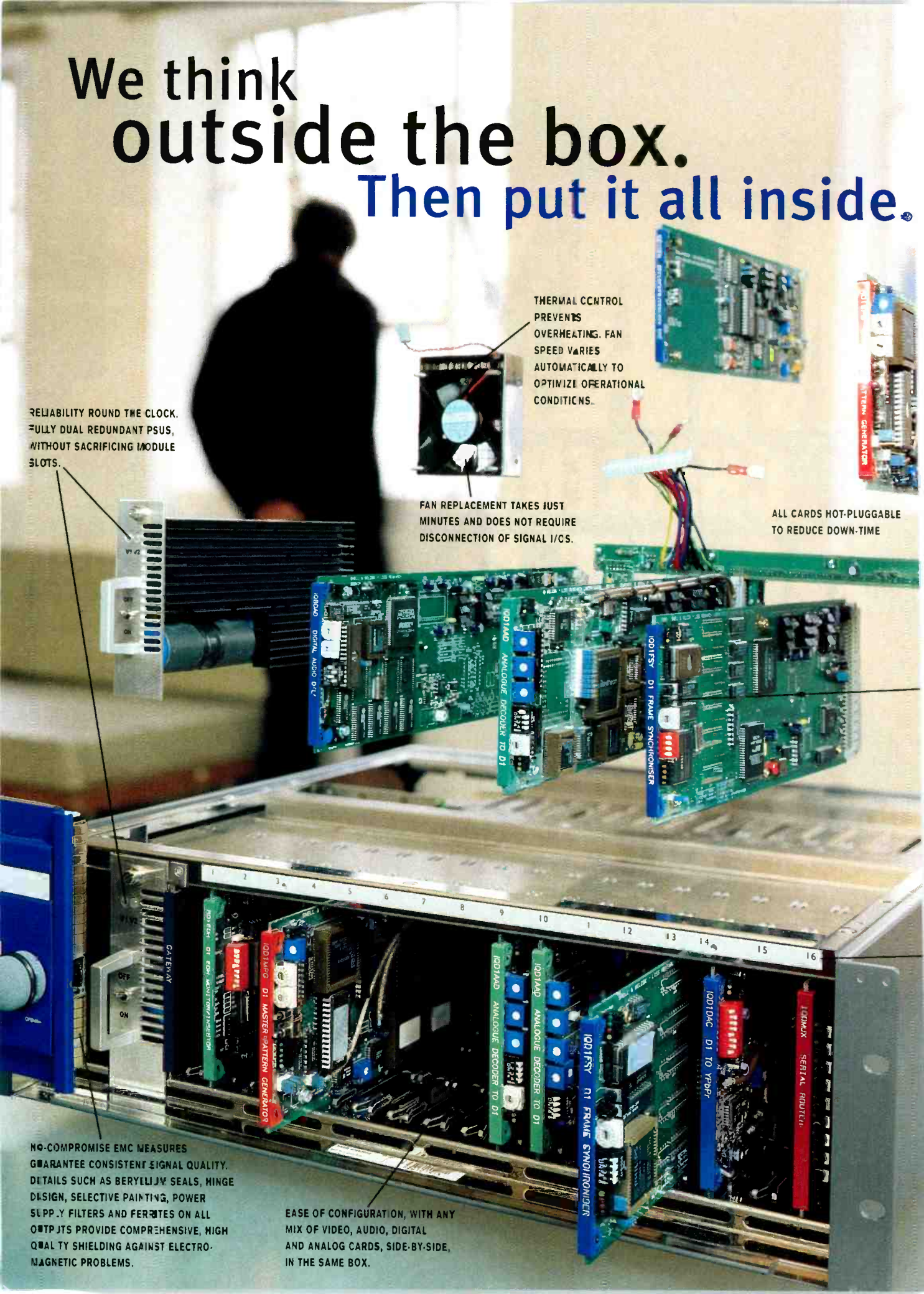

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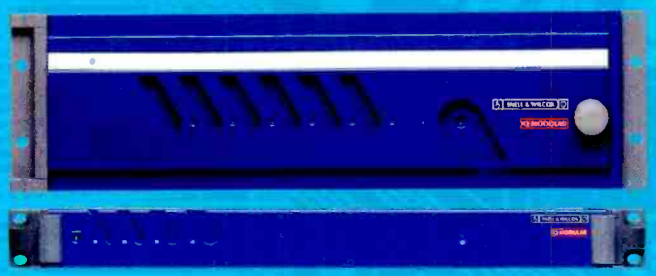

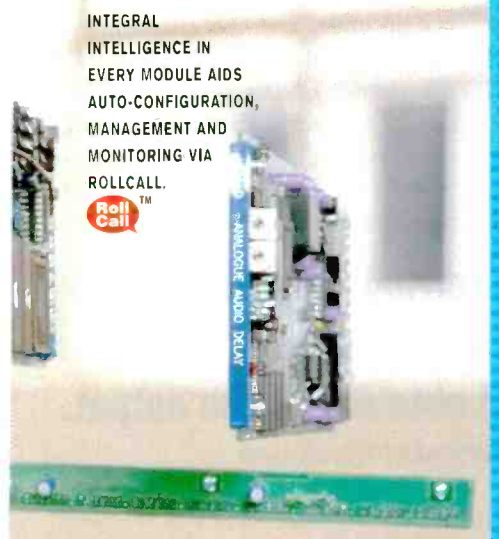

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# Testing link performance

BY MICHAEL ROBIN

The term *contribution* implies that the signal is originated in a remote location "A" and is delivered to location "B," where further analog signal processing, like mixing with other local signal sources, will occur. Figure 1 shows a typical analog contribution link setup.

Location A feeds the telco with signals meeting quality-control requirements as monitored on a waveform monitor, vectorscope and color monitor. At location B, the received signal is fed to input A of a monitoring/test package consisting of a waveform monitor, a vectorscope and a color monitor. Not shown in the diagram is an optional equalizing distribution amplifier between the telco interconnect point and the input B of the monitoring package. The signal is then fed to a frame synchronizer that stores the non-synchronous incoming signal in a digital memory. The memory is read out at the local sync rate producing video signals that are synchronized, timed and phased to match other local signal sources. This process is required to allow the mixing of the remote signal with locally generated signals. The output of the frame synchronizer feeds input B of the monitoring package and the production area.

The analog transport medium may be a coaxial cable, a fiber optic cable or a satellite system. It delivers the video signal to location B but also introduces video signal impairments. In the world of the NTSC analog video signals, the performance indicative parameters are grouped into three categories: linear distortions, nonlinear distortions and noise.

**Performance testing is carried out by feeding a test signal to the input and measuring the distortions of the signal obtained at the output.**

Performance testing is carried out by feeding a test signal to the input of the system under test and measuring the distortions of the signal obtained at the output of the system. For off-service test purposes the NTSC composite source is a video test generator feeding full-field test signals. Alternately, for in-service test purposes, selected test signals (VITs) are transmitted in one or several lines of the vertical blanking. The system under test is the analog transport medium under the responsibility of the telco organization. It is usual to divide the responsibilities by clearly identifying the interconnect points.

Years of accumulated experience, resulting in national and international standards, led to the development of test methods and equipment that uses a set of specific test waveforms. The various test waveforms stress the distribution medium, which reacts by distorting the test waveform. The measurement of the resulting distortion yields figures that clearly identify the source of trouble. The performance test philosophy is based on the fact that there is a direct and well-understood relationship between the shape of the test waveform (the medium) and the perceived picture quality (the message). To paraphrase Marshall McLuhan, the medium is the message.

## The digital link

Figure 2 shows a suggested digital contribution link setup using MPEG-2 compression. As in the analog case, the term "contribution" clearly restricts

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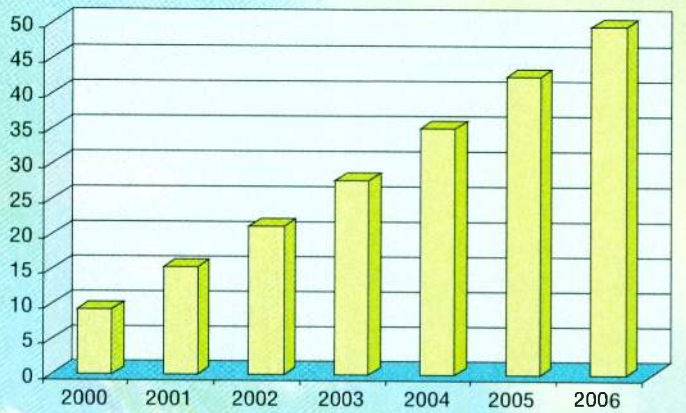

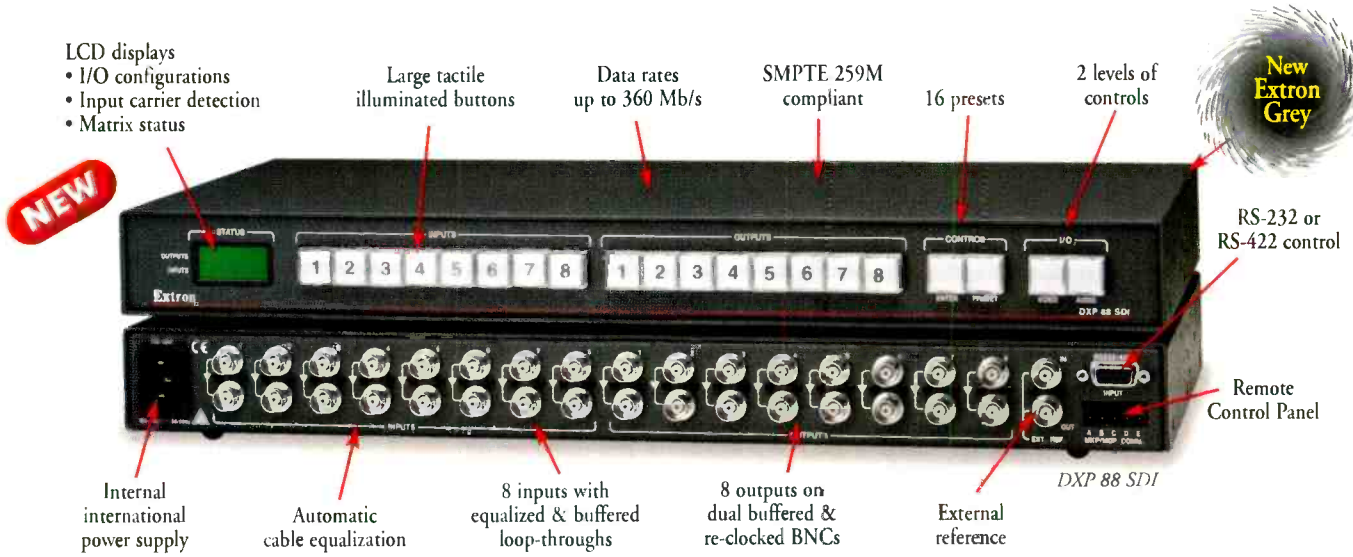


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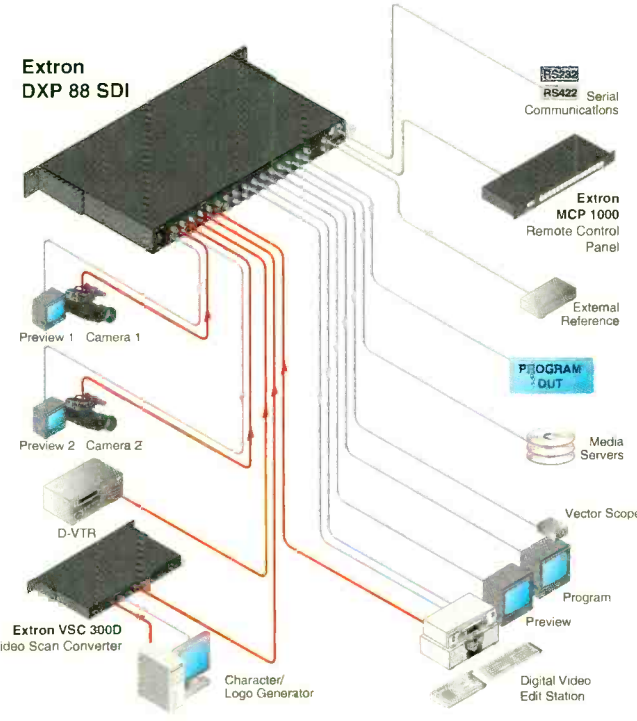


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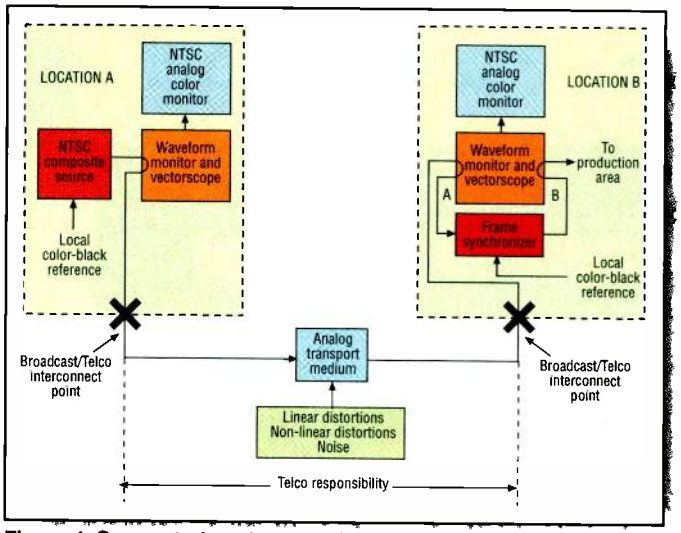


**Figure 1. Suggested analog contribution link setup**

the signal path to delivering digital signals that will be further digitally processed. Location A feeds the telco with a serial digital video source signal (SDI) at 270Mb/s, which meets the requirements of SMPTE 259M Standard. These requirements include p-p signal amplitude, rise/decay time, overshoot/undershoot and timing/alignment jitter. These signal characteristics are measured and monitored with a serial digital waveform monitor, which in turn feeds decoded G,B,R analog component signals to a component analog color monitor. The waveform monitor can display and measure the characteristics of the SDI signal (the medium) as well as the component analog Y, B-Y, R-Y signals (the message).

At location B the SDI signal delivered by the telco feeds input A of a digital waveform monitor and a frame synchronizer. Not shown in the diagram is an optional equalizing/reclocking SDI distribution amplifier needed to regenerate the signal in case of a long coaxial cable feed. The frame synchronizer genlocks the incoming SDI signal to the station reference to match other locally generated SDI signals and eliminates timing and alignment jitter. While typical MPEG decoders may eliminate jitter, the ones I have encountered have no means to be genlocked to station reference, hence the need for a separate frame synchronizer. The output of the frame synchronizer feeds input B of the waveform monitor and the production area.

Prior to signing the contract with the telco company it is safe to carry out evaluation tests of the compression technology to be used including the transport medium if possible. The purpose of these tests is to obtain certain objective performance indicative figures, which reflect the performance of the system. Note that analog type test signals are unsuitable for testing digital systems and that VIT test signals are not passed.

The MPEG-2 encoding/decoding process generates artifacts whose degree of impairment of the perceived picture is directly related to the compression ratio. Figure 3 shows some of the compression related artifacts. Cost vs. performance considerations inevitably lead to choosing a link with the lowest bit-rate, which produces acceptable picture quality. By necessity, a high compression ratio will result in a lower picture quality. Here things get quite complicated. The acceptable picture quality is essentially a subjective concept. In analog video there is a well-defined and understood relationship between a distorted video waveform and the perceived quality of the resulting picture. In other words a distorted waveform means a poor picture. In the digital world the shape of the digital signal does not directly relate to the perceived picture quality. Essentially the digital waveform may be quite distorted while the perceived picture quality is excellent.

A number of manufacturers have developed objective picture quality measurement methods and equipment. In several instances I have used the Tektronix PQA200 system. This unit expresses the performance of the compression/decompression system under test in terms of PQR (picture quality rating) and PSNR (peak signal-to-noise ratio). The measurement philosophy is based on the JND (just-noticeable difference) concept developed by the Sarnoff Research Center. The method used compares the image fed to the input of the system with the one present at the output of the system pixel by pixels and expresses the difference in numbers that reflect the image degradation as perceived by the HVS (human vision system). This test requires simultaneous access to the input and output of the system under test. The performance level is expressed in PQR units related to the CCIR five-level impairment scale. PQR measurements can be carried out on the luminance signal only (PQRy) or on both the luminance and chrominance signals (PQRyc). PQRyc measurements require a longer time but offer a more complete analysis. In addition the unit performs PSNR measurements.

Various image sequences are available on CD-ROM disks. A test sequence lasts five seconds of which two seconds are used for analysis. From the large number of test picture sequences I have been using three namely: "Diva", "BBC" and "Mobile with calendar" each with distinctive picture

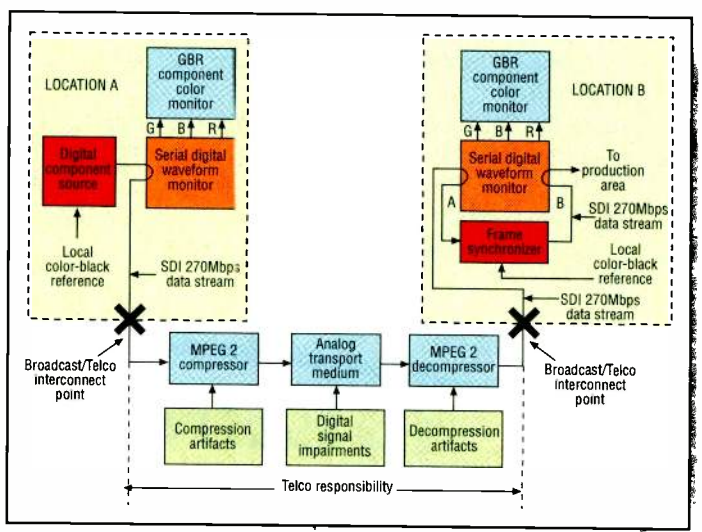


**Figure 2. Suggested all-digital contribution link setup**

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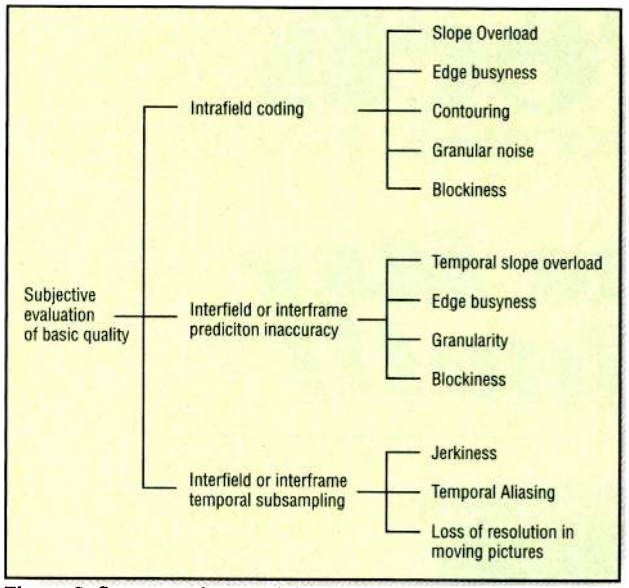


**Figure 3. Compression- and decompression-related artifacts.**

details and movement complexity: "Diva" is the less stressing and "Mobile with calendar" is the most stressing.

In addition to PQA tests, it is advisable to carry out several additional tests to determine the effects of the digital medium on the analog "message." Among these tests are:

- Frequency response: Feed an SDI YCbCr multiburst sequence to the input of the system and verify that all packets are passing. This test verifies that all 704 luminance horizontal pixels and 352 chrominance horizontal pixels are passing through. A reduced number of pixels would affect the frequency response by cutting off high frequencies.
- Dynamic range: Feed an SDI limit ramp YCbCr signal to the input of the system and verify that all levels specified in CCIR 601 are passed. For an eight-bit system the dynamic range extends from $01_h$ to $FE_h$ with a bottom headroom of 01h to 19h (black level) and a top headroom of $EB_h$ (white level) to $FE_h$.

## The hybrid link

In the transition period from analog to digital systems there are likely to exist some types of hybrid systems. A typical hybrid system would consist of a digital link with the following additional equipment:

- **A/D converter:** This unit converts the analog NTSC signal to an SDI signal feeding the input of the telco MPEG-2 compressor. For best performance it should feature a digital adaptive comb filter with full bandwidth luminance and chrominance signals.
- **D/A converter:** This unit converts the SDI signal at the output of the MPEG-2 decompressor to an analog NTSC signal. In addition it works as a frame synchronizer, eliminating the SDI jitter and genlocking the analog NTSC signal to station reference. ■

*Michael Robin, a former engineer with the Canadian Broadcasting Corporation's engineering headquarters, is an independent broadcast consultant located in Montreal, Canada. He is co-author of* Digital Television Fundamentals, *published by McGraw-Hill.*

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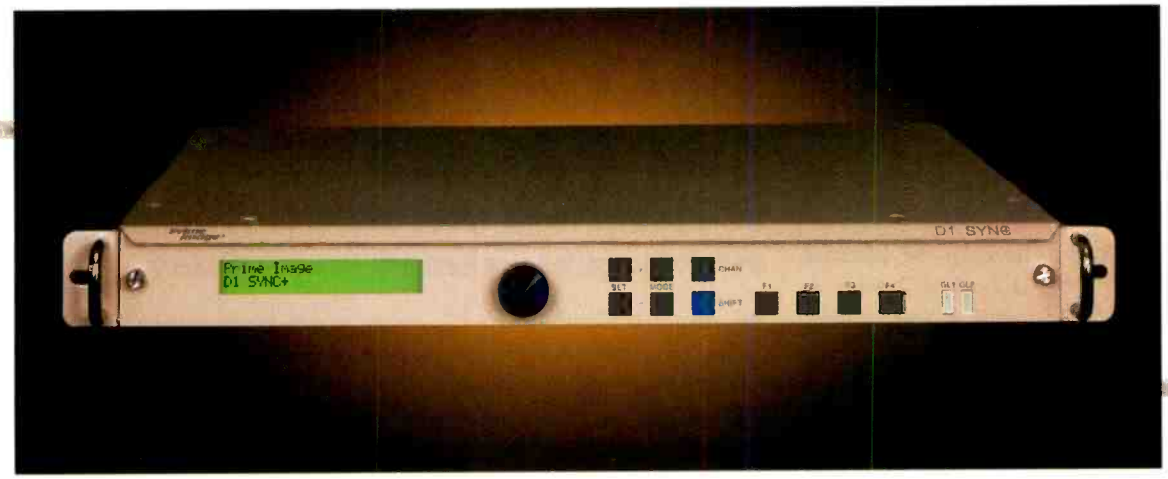


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# Firewalls and security

BY BRAD GILMER

In the beginning, security was a simple matter. Access to a central mainframe was only available through dedicated, hard-wired terminals. If anything bad happened to your system, it was not hard to track down the culprit. As standalone Apple and PC systems began to appear on desktops, the main security threat was through viruses acquired by downloading tainted software.

Today, desktop systems using xDSL or cable modems are connected to the Internet full-time. Almost all corporate networks have at least one if not multiple connections to the Internet. Most software is now delivered on CD-ROM and, with a few notable exceptions, is virus-free. These days, it is much more likely that your computer will be affected by tainted e-mail or by a direct break-in attempt via the Internet rather than by a virus distributed in a computer program. Broadcasters are particularly sensitive to threats. Over the past few years, the systems that create and play out programming have become increasingly dependent on desktop operating systems and applications.

What is the root cause of the problem? Computers can be more effective tools when they are connected together than when they operate as islands. However, when computers are connected, they can be accessed directly by others or affected by damaging programs sent by e-mail or some other method. To protect against a security problem, you must first understand the nature of the threat.

**When dealing with on-air operations, you want to have the security as tight as it can get while still permitting necessary functionality.**

The first, obvious threat is someone sitting down and typing on your computer. You can easily eliminate this threat by using the protection provided with your computer. Most computers have power-on passwords. You also can use the password protection built into the operating system.

While having someone sit down in front of your computer and steal your secrets may seem like an obvious threat, my experience has been that this method is not frequently used. A second, less obvious threat is someone stealing your password to gain access to a network containing confidential information. Usually this password can be used from any location inside or outside your facility. How do people get your password? Professionals say that most of the time they get passwords by guessing them. Birthdays are a common choice; so are the names of children and pets. To make your password more difficult to break, it should not be obvious, and it should include punctuation or numbers. If you have even basic knowledge of a foreign language, a non-English word can be a good choice as well.

Viruses are another source of internal threats. A common characteristic of almost all viruses is that they replicate themselves. If you have a virus on one computer, you'd better check for viruses throughout your facility.

These days, viruses are most commonly passed via e-mail programs or embedded in documents. Many popular e-mail and document creation programs have macro languages. These languages allow users to create scripts that automate complicated or repetitious tasks. Unfortunately, these macro scripts also can be used to write programs that can cause problems. (See Figure 1.)

The best way to defend against viruses is to use a virus scanner. Unfortunately, viruses mutate quickly. For this reason, all popular virus scanning software comes with an update service. The updates train the program to recognize new viruses that have been identified since you purchased the original program.

While stolen passwords and viruses can cause major headaches, some of the most serious threats come from outside. Once your computer or network is connected to the Internet, you are open to a possible attack. This is where a firewall comes into play. A firewall serves several purposes. First, it filters all incoming Internet packets, allowing only authorized traffic to pass through. Second, it conceals the IP addresses of internal machines from the Internet. This makes it much more difficult to

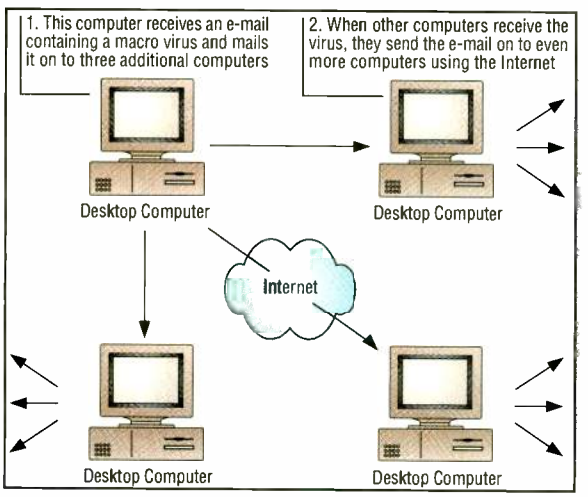


**Figure 1. E-mail viruses are spread using macros. The macros automatically mail the virus to all the addresses listed in the computer's address book.**

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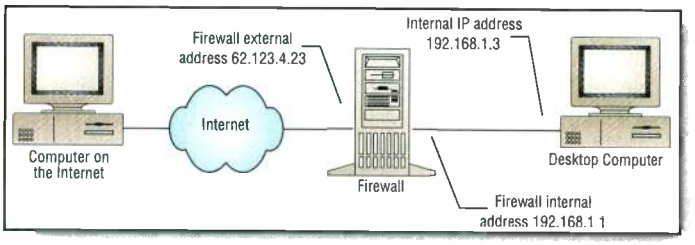


**Figure 2. Network Address Translation hides the true IP address of a computer inside the firewall.**

locate and attack a particular machine inside the firewall. Almost all firewalls provide additional functionality, but let's stick with the basics for now.

How does a firewall conceal the address of an internal computer? It performs Network Address Translation or NAT. With NAT enabled, any messages sent to the Internet are modified so that it appears that the message originated from the firewall. As shown in Figure 2, any messages coming from the internal desktop PC with an IP address of 192.168.1.3 will be modified so that the PC on the Internet sees them as originating from the firewall with an IP address of 62.123.4.23. A query from the PC on the Internet sent to 192.168.1.3 will likely return an error. This is important because the firewall keeps the PC on the Internet from connecting directly with the desktop PC. It also makes it more difficult to attempt to break into an internal PC or server because the person attempting to break into the device must first guess its IP address.

Another way firewalls limit access is to allow communication only to authorized ports. The Internet functions by using well-known port addresses. For example, when you point your Web browser at a particular URL, the browser will automatically attempt to connect to port 80 unless you tell it otherwise. Web servers are designed to listen to requests incoming on port 80. If a network administrator wants to block incoming Web access, he can program the firewall to reject all communications with port 80 inside the firewall. See Table 1 for other well-known port numbers. For a complete list of port numbers, go to www.iana.org/assignments/port-numbers.

If the firewall uses stealth to hide ports, a computer making a request on the stealth port will receive no response. A firewall programmed to block the ports associated with file sharing will block requests from the Internet to that "port" on your computer. Without a firewall, file sharing within your network will likely extend to the Internet.

Are you curious to see how well your company's firewall conceals your desktop computer's identity? Then point a Web browser to http://grc.com/lt/leaktest and run the listed test. It will tell you if your computer is advertising its existence to other computers on the Internet. It also will tell you whether particular ports on your system are visible to the outside world. The GRC site will test your computer at home just as well as a computer at work. If you have a computer connected to the Internet via a high-speed connection such as xDSL or through a cable modem, run (don't walk) to your computer and go to the GRC site.

If you find that your computer is exposed, you should install some form of firewall software. The GRC site lists several different firewall products. You will also find firewall functionality included in almost all major anti-virus programs. In addition to the GRC site, several popular computer magazines have reviewed security and software solutions. If you are in charge of a network used for broadcast operations, I strongly encourage you to read up on this subject.

The best way to protect your broadcast computer networks is to avoid any direct connection to the Internet. If you do have to connect your local network to the Internet, be sure to install a good firewall and check its performance regularly. Most firewalls can be set to different levels of security, restricting communications more and more as the level of security increases. Obviously, when dealing with on-air operations, you want to have the security as tight as it can get while still permitting necessary functionality. ■

| Service | Port | Description |
|---|---|---|
| SSH | 22 | Secure shell |
| Telnet | 23 | Telnet terminal |
| SMTP | 25 | Simple Mail Transfer Protocol |
| Http | 80 | Hypertext Transfer Protocol |
| Kerbos | 88 | Secure communications protocol |
| Pop3 | 110 | Post Office Protocol |

**Table 1. Well-known Internet port numbers. Firewalls can prevent Internet attacks on internal PCs by blocking outside communication with port 80.**

*Brad Gilmer is president of Gilmer & Associates, executive director of the AAF Association and technical facilitator of the Video Services Forum.*

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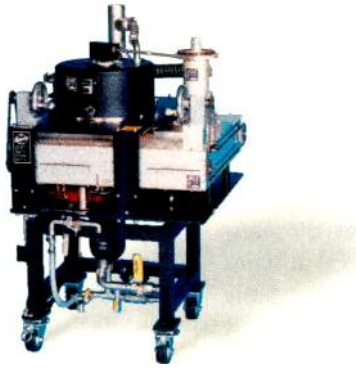

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# Streaming vs. file download

BY STEVEN M. BLUMENFELD

This month, a question that has plagued/delighted me for the past two years: Which is better — streaming or file transfer? Actually, this was once the topic of a whole panel discussion. I was lucky to have the responsibility for three large music sites utilizing downloads (Winamp.com) and streaming (Spinner.com and SHOUTcast.com).

What is so interesting about this argument/controversy is that these are two different applications that result in different outcomes.

Streaming is used when a real-time transfer is required. Whether a file is live or stored is somewhat inconsequential. We stream media because we want our audience to believe they are getting a broadcast type service. Downloading requires a long wait time in order to begin consuming content. Instant gratification is achieved only through streaming. Should we then give the audience what they want instantly? The drawback to this is that when we stream we are confined by the nominal average available bandwidth.

File transfer, in most cases, does not supply the instant gratification. There are some file transfer protocols that are fast-start transfers — where the file is played back prior to the whole thing being downloaded. But this has its problems too. If the network is unable to deliver enough bits, playback stops as soon as it reaches the current downloaded bits.

File downloads allow for the maximum efficiency of your server complex. Files are stored in a specific location and then are accessible to remote users to copy. This is usually done through the File Transfer Protocol. The objectives of FTP are to promote sharing of files and transfer data reliably and efficiently.

In the FTP specifications the user-protocol interpreter (user PI) initiates a control connection that follows the Telnet protocol. At the initiation of the user, standard FTP commands are generated by the user-PI and transmitted to the server process via the control connection. Standard replies are then sent from the server-PI to the user-PI over the control connection in response to the commands. The FTP commands specify the parameters for the data connection and the nature of the operation (store, retrieve, etc.).

**With a downloadable file the content owner is much more vulnerable.**

Beyond the technical difference, there is the more important issue of digital rights management. Dare I say that when it all boils down, the technical issues of various transports become less relevant than the business rules — the way to make money off that stuff we want to stream or download. The way we should control access and protect our content. This really lies between these two types of information transfer.

Streaming is relatively safe. The files are played back in real time from the server to the user's device. The content is substantially stored remotely and has a very short time to live. It is hard for a user to capture this information as a digital file.

With a downloadable file the content owner is much more vulnerable. The content is usually of higher quality/bit rate and therefore has higher value. It also has a long time to live, can be easily transported and stored locally as an exact copy of what was on your server. This makes it more vulnerable to being hacked. Peer-to-peer networks must also be taken into consideration when protecting rights holders.

Digital Rights Management (DRM) allows providers of content to securely reach consumers. In basic terms, most DRMs are applications that wrap content in an encrypted layer of information and rules. These rules include such things as time to live, decryption or keys, watermarking and/or copyright information, and classification of use and users.

There are a number of companies in the field supplying DRM technologies. InterTrust is one such company.

The InterTrust architecture is based on InterRights Points, software acting as a secure "virtual machine" to manage digital rights and create a local, secure database that stores the user's rights, identities, transactions, budgets and keys.

With most DRM systems, usage is managed by rules. In addition to the previously stated rules, there are others for price, payment offer, play, view, print, copy, save and distribution. Rules are linked directly to the content, can be changed dynamically and are protected in the same way content is protected. Interestingly, rules can travel with the content or separately, allowing the flexibility to change any rule after content has been delivered. The system ensures that applicable rules are followed every time an information usage event is requested. This means the content remains protected after a user has accessed it.

Let's bring this article back full circle to streaming and downloads. Each has its rules, risks and limitations. Know your objectives, understand the limitations of your content and always listen to your audience. They will let you know what they want. Your job is to decide how best to get it to them. ■

*Steven M. Blumenfeld is currently the vice president of advanced services for America Online.*


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SYSTEMS DESIGN SHOWCASE

# Lower East Side addresses NYC's creative migration

By Bob Giammarco and Neil Karsh

With the migration of many creative advertising agencies, production companies and editorial houses to lower Manhattan neighborhoods like Soho, Noho, Union Square and Tribeca, audio facilities have quickly followed suit to service them. One of the first high-end audio facilities on the downtown post-production scene was Lower East Side (LES).

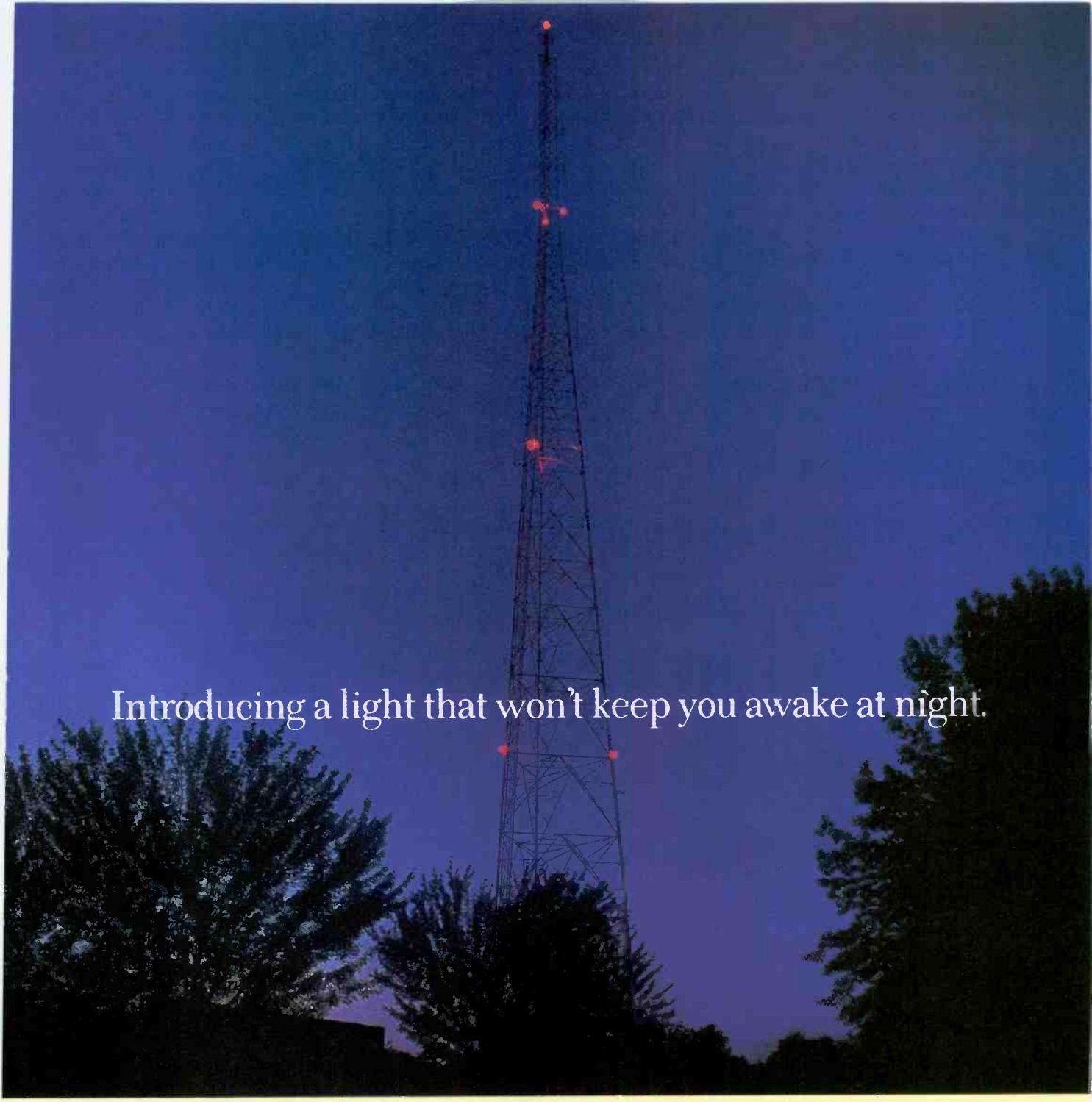
To better accommodate clients and prepare for high-definition broadcast audio, NYMG opened the nearly 6000-square-foot LES facility in the Union Square District. The two-room complex, designed by the award-winning Walters-Storyk Design Group, integrates the latest elements in technology and design in a spacious, sun-soaked loft environment. The project, a complete strike and build/design, was accomplished within a tight 90-day schedule.

A number of design objectives for the project were clearly defined, including client comfort throughout the complex; creation of two large, identical control rooms, each with a "living room" area; an industrial-look interior with a minimal amount of exposed equipment; window views from all rooms; a central machine room (CMR); expansion room for two additional suites in the future; easy wire management between studios and CMR; all digital audio (5.1 surround sound); and 16:9 video.

## Architecture and acoustics

Initial designs and plan development drawings revealed that due to column spacing in the loft, the two identical control rooms would be long

Two identical studios in Lower East Side's new complex serve the audio production needs of advertising companies in downtown Manhattan. Photos by Robert Wolsch.

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in comparison to their widths and height (nearly 12 feet). Column spacing and the desire for large amounts of natural light in the studios required the suites to be oriented along the 13th Street grid of the building. Imagine a semi-traditional control room with a living room added to the rear. LES' vision of the rooms allowed no division between engineer and client. This meant eliminating the traditional rear producer's desk, loaded with audio processors. Instead, clients would have their designated area to work and listen, but would not be physically separated from the primary listening and engineering position.

The final facility layout created two identical studio suites, each with a sound lock, a large listening/production room (including client area), a private client lounge/office, and an ISO/vocal booth capable of recording up to three people. (See Figure 1.) The large open loft site inspired the company to take full advantage of the extensive windows and enhance the "downtown" residential feel of the rooms with natural woods, lots of light, exposed ceilings in corridors and plush furniture.

The CMR is truly central to both suites and is accessed via a raised wire raceway floor in front of each control room, allowing wires to enter beneath the raised computer floor in the CMR. The entire hallway floor outside both suites has been raised to be equal in elevation to the raised isolated acoustic floor of the control room. There are no steps in the facility. The hallway serves as a wire management raceway system as well as the primary HVAC ductwork path. Exposed ductwork maintains the loft design esthetic and creates an affordable ceiling design.

Quietness and acoustic isolation posed formidable design challenges. The site proved to be an excellent choice, as the building (a former manufacturing building) has structural floor slabs over eight inches thick in concrete and flat masonry units. Noise

**The project, a complete strike and build/design, was accomplished within a tight 90-day schedule.**

Criteria (NC) 20 ratings are the design standard for all of the critical recording and listening spaces. This was achieved with a full floating "room within a room" design. Despite large window views to a noisy downtown exposure, this rating was maintained throughout. (See Figure 2.) Rim rollout isolated flooring by Kinetics Corp., as well as a lid acoustic ceiling system, provided the required isolation. Window detailing to the outside is similar to typical control room/live room window construction, although removeability was an issue due to the need for periodic cleaning.

Note that additional layers of gypsum board in the isolated floor mass add another five to six lbs. per square foot. Due to the weight of the walls,

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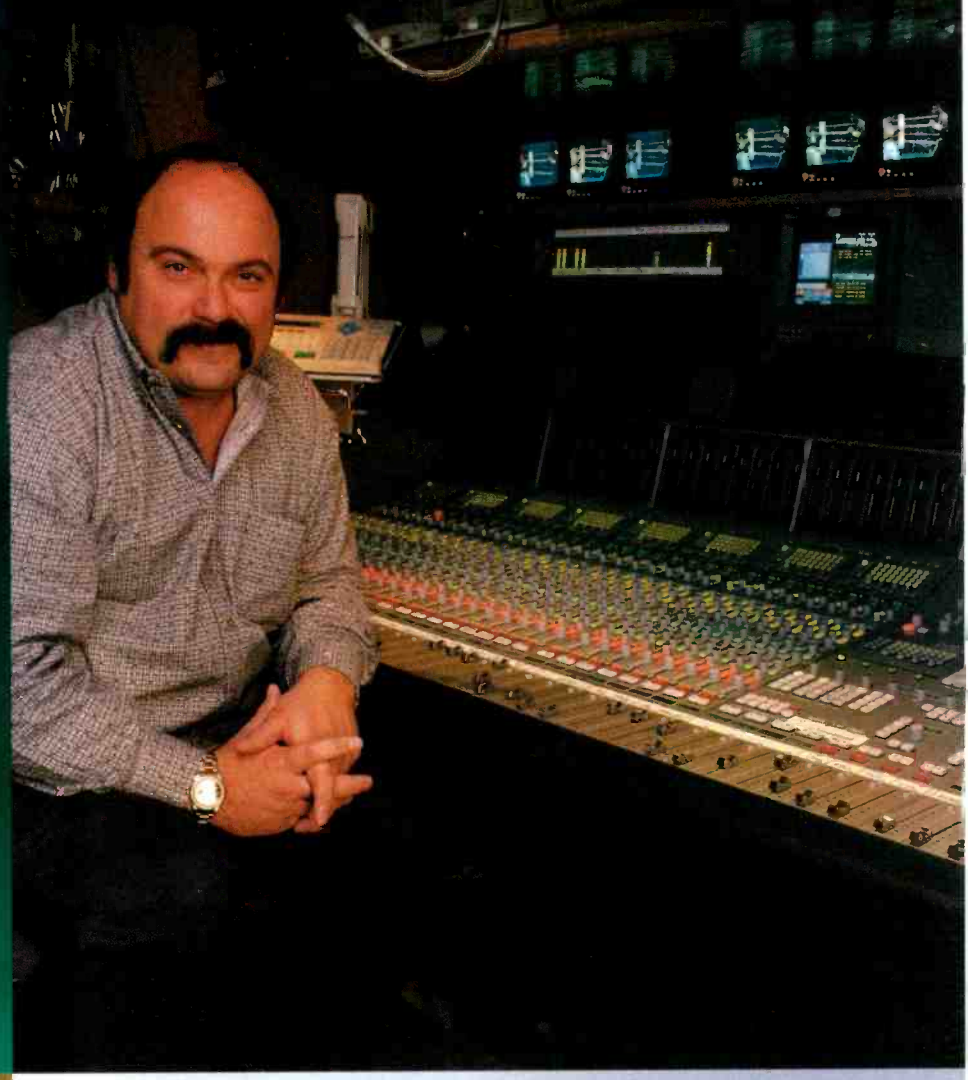

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SHAWN O'SHEA DIRECTOR OF ENGINEERING AND OPERATIONS, SOUTHWEST TELEVISION (SWTV) - A DIVISION OF CORE DIGITAL TECHNOLOGIES

Aysis air

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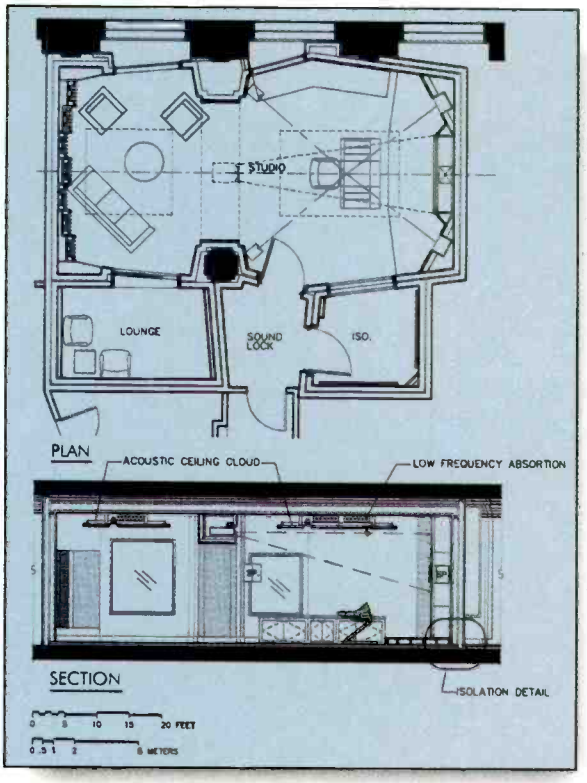


**Figure 1. Studio facility plan. The unusual dimensions of the studios required special attention to their low-frequency modal response.**

additional spacing of rubber-coated isolators takes place on the perimeter of the floated rooms, with two types of spacing, depending on whether the wall is load bearing or not.

While room construction had to be 5.1 capable, space doesn't come cheap in a market like New York. Although everyone in the suite cannot be seated in the sweet spot, Storyk designed the rooms so that the mixer is right in the center of the surround field. Producers can move around easily and listen to the full surround imaging whenever necessary.

Attention was paid to low-frequency modal analysis due to the exaggerated length-to-width ratio of the studio suites. Initial studies indicated a modal response that was quite reasonable but still required additional targeted low frequency treatments. This was accomplished by using membrane absorbers placed above fabric-suspended ceiling clouds. In addition to the two ceiling clouds, an arch was designed to separate the control room from the "living room." Collectively, these elements were used to control mid- and high-frequency reflection, modify the natural low frequency modal response of the room, create an integral 5.1 environment, and house the noisy LCD projector.

Heating and cooling was another vital issue. The HVAC system was a complex install — given the sensitive sound requirements (NC 20). The site had lower than average ceiling clearance compared to most New York loft-style spaces. Squeezing in all of the necessary ductwork, which LES wanted exposed, resulted in an intriguing network of ducts with a raw look particularly appropriate for the loft setting.

Wiring was an equally knotty factor. Located between the two studios, the CMR represented a seven-week-long jigsaw puzzle of literally thousands of wires and connections. New risers were run to meet power demands. In anticipation of future developments, the facility was wired with high-definition broadcast in mind and incorporated all the proper specifications of wires, cabling and distribution amplifiers into its design. Jersey City-based Taytrix was retained to wire the complex. They brought in a team of independent engineers to work from various schematic AutoCAD drawings created by the LES team. Half of the wiring was completed off-site.

Each of the control rooms features a Soundtracs DPC-II console. The suites also are equipped with an Avid AudioVision as the primary editor; a Pro Tools Mix Plus system; JBL LSR32s, LSR28P and LSR12P monitors on the mains; Spendor A300s on the nearfields; Sony video monitors; and the Avid Media Doc, a multi-bay rack that can hold up to eight drives, for storage. Supporting all significant formats, the CMR houses D1, DigiBeta, D2, Beta SP, 3/4-inch, and 1/2-inch. LES chose to go with localized switchers instead of a totally automated router because there wasn't an overload of equipment to make it necessary. The audio rooms are networked through an FTP centralized server.

Video was an early concern for these rooms. A large, high-quality image in the front of the room was an important requirement. Several options were discussed. Ultimately, native 16:9

**LES' vision of the control rooms allowed no division between engineer and client.**

**Control rooms in LES' new facility were designed to eliminate the division between the engineer and the client, giving clients a "living room" area (shown above) in each control room from which they can observe production.**

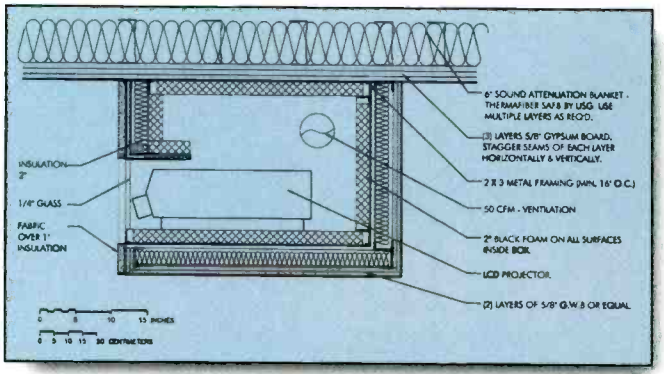


**Figure 2. The metal stud and multiple gypsum board construction used for isolation in LES' studios.**

formatting and 5.1 surround (center channel speaker) requirements dictated that front-viewing LCD projectors be selected because they provide more lumens. Front projection allowed critical center channel placement—same alignment with side front speakers. The projector was housed in the mid-room arch. This arch also helped create front room symmetry that is critical for accurate 5.1 monitoring, and the housing quieted the noisy LCD projector. At the same time, some 50 cfm of air for cooling was provided.

Construction was handled by another long-time WSDG associate, Chris Bowman, and a team of contractors from his New York firm CHBO Construction. Construction time was approximately four months.

Since its opening, the facility has become the audio flagship of the New York Media Group. It has been extremely well received by the broadcast and advertising community. Recent projects include national spots for such clients as Procter & Gamble (Folgers), McCann-Erickson (Burger King, Coca Cola) and BBDO (Pepsi). The Folgers spot also was done in high definition. There has been only a minimum amount of 5.1 mix work, but audio standards for surround continue to be solidified and the demand for that work continues to grow. Lower East Side stands ready to accommodate virtually any form of digital audio production work for the advertising community. ■

*Bob Giammarco is senior audio engineer at Lower East Side, and Neil Karsh is the former vice president of audio services of the New York Media Group.*

## Design team:

John Storyk, Walters-Storyk Design Group (NY), principal architect/acoustician

Neil Karsh, systems integration/project manager

Bob Giammarco, Lower East Side, project visionary

Chris Bowman, CHBO Construction, general contractor

Tay Hoyle, Taytrix, wiring

Marcy Ramos, HVAC designer

Robert Wolsch, lighting and electrical design

## Equipment list:

Soundtracs DPC-II digital console

Avid AudioVision 16-track DAW

DigiDesign Pro Tools 24-track DAW

Sony PCM 7040 TC DAT

Tascam DA30 DAT, DA-88, DA-98

Dolby SEU4 matrix encoder, 562 5.1 decoder

JBL LSR32 LR speakers, LSR32 center speakers, LSR28P surround speakers, LSR12P subwoofer

Leitch 16x1 video switcher

Sony video monitors

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# Networking for Production and Storage

BY BOB PANK AND JON SMITH

As the onward march of IT-based equipment into broadcast television continues to accelerate, there is an increasing need to look carefully at the way items connect together and work together. Networking and storage networking is the key. These can change, and hopefully improve, workflow and take full advantage of the possibilities that become available with the new IT technology.

Sky Latin America's Origination Facility's banks of Tektronix (now Grass Valley Group) PDR300 video servers. Photo by Andy Washnik. Photo courtesy of A. F. Associates.

*A Supplement to*

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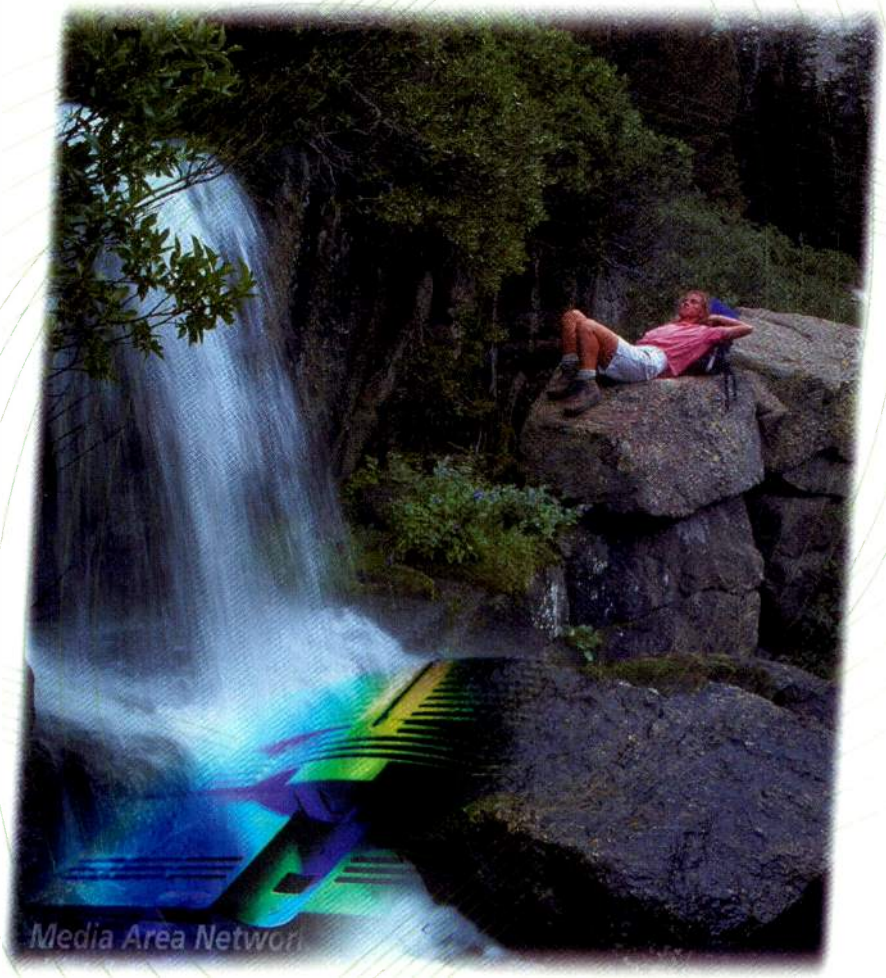


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While some analog systems continue to linger, most have already moved to component digital operation. Standard definition (SD) video is digitized according to ITU-R 601 and this, along with AES/EBU digital audio, is carried over familiar coax cable up to 200m using the Serial Digital Interface (SDI), which has a data rate (bandwidth) of 270Mb/s. Modern digital studio equipment comes complete with SDI connections so all the components of a facility — cameras, switchers, DVEs, recorders, routers, etc. — can be quickly hooked up.

SDI is designed just for television. It is real-time "streaming" with very low latency (i.e. delay) — material can be instantly used as it arrives. Communication is "best effort" and one-way, so it does not have the degree of error correction of many IT-based schemes, but this is no problem for the type of material involved.

There is also IT-based equipment in use, especially in graphics and editing, that may or may not have an SDI connection but will connect over an IT network. Rapid change is moving the balance toward IT-based equipment and networking. Two years ago some post houses counted more network than video connections. Some are now (almost) completely IT-based.

Few would doubt the potential benefits of the changes afoot. However, handling video and audio – television content – is far from the native "data" environment of IT-based equipment. More than ever, correct system design is essential. To better understand this requires some knowledge of both networking and disk storage applied to television. These technologies lead to the currently "hot" area of storage networking. In storage networking, storage is shared, as opposed to networking, where various stores exchange data. Both depend on network technology.

## Networking

Networking can be defined as communication using a series of data packets. SDI does not work this way and so cannot make a network, but its extension, SDTI (Serial Digital Transport Interface), can by carrying packetized data over SDI infrastructure. This transports material such as MPEG, DV and even HDCAM compressed video in real time. (DV can be carried at 4x faster). However, it has limited general IT application. The further extension of SDTI-CP standardizes the format of data sent down the cable.

With television so well provided for by SDI and SDTI, why look at IT-style networking? Growth in services could continue by adding SDI interfaces to all new IT-based equipment. The truth is that networking is IT's native way of communicating. Moving away from that would spoil some of the advantages the equipment brings — including the ability to work with shared storage. As IT has many applications, it also has many methods of networking. Only those appropriate to television are mentioned here.

**Server systems like the Grass Valley Group Profile PDR400 enable the transfer of material to editing systems via Fibre Channel, letting feeds flow directly into the newsroom and workstations. Photo courtesy Grass Valley Group.**

Networking offers many advantages:

- It offers cost savings in infrastructure and operation.
- It provides transport of all required information: video, audio, metadata, control, talkback – virtually anything you wish to put down it.
- It is the only way to create shared access to data.
- It has plug-and-play capabilities for easy use.
- With standard platforms, networking can be easier and cheaper than SDI.
- You need a network for all the desktop computers in broadcast, so why not use it for video and audio too?
- It can handle live SD video (although this is not straightforward).

## Types of networks

There are many types of network in use but LAN and WAN are the most common. The local area network (LAN) is spread throughout a building and may have thousands of connections. It is of particular interest as it can be directly applied to studio/post house needs. Breaking out of one location forms a wide area network (WAN). Two LAN sites can be connected by a WAN. The connection normally is rented from a telco or ISP.

Others include metropolitan area networks (MAN), which are generally telco/ISP systems for handling traffic in a city or suburb. Personal area networks (PAN) are just appearing. These provide very short-range wireless networks (less than 30 feet for Bluetooth) – for instance, between your laptop and PDA.

For general networking information, see http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/.

*Ethernet.* Ethernet (IEEE 802.x) is ubiquitous and remains the choice for data exchange between IT equipment–traditional networking. It has undergone continuous development since its early 1980s 10Mb/s origins. 100Mb/s is in general use and 1Gb/s is also well established, while 10Gb/s is on the way. Note that numbers always need careful interpretation. Here 1Gb/s data speed is actually 1.25Gb/s transmission, but coded 8B/10B. (Every eight-bit data byte for transmission is converted into a 10-bit Transmission Character to improve the transmission characteristics for more accuracy and better error handling.) All standards above 10Mb are capable of full duplex operation — full data rate in both directions simultaneously.

Ethernet is a connectionless architecture. Each data packet, of between

72 and 1518 bytes, has a destination address and all connected devices listen for this and decide whether it is for them or not. A device (e.g. a PC) waits for the line to be quiet before starting its transmission. A mechanism called Carrier Sense Multiple Access Collision Detect (CSMA/CD) handles cases where two stations attempt to transmit at the same time. It follows the rules of polite conversation; they simply wait a random length of time before starting again.

For further information see http://standards.ieee.org/getieee802/

*Fibre Channel.* Today, most FC is 1Gb/s transmission speed, which, again due to 8B/10B encoding, is an 800kb/s maximum data speed. A newer standard of 2Gb/s has existed for some years but is only now coming into general usage. Both are capable of full duplex. Despite its name, FC can run over copper as well as fiber connections. Because of its close association with disk drives, its TV application is mostly, but not always, in the creation of storage networking.

The two primary ways of interconnecting FC devices are via Fibre Channel-Arbitrated Loop (FC-AL) or the more powerful fabric switching (see Infrastructure Devices). Like Ethernet, FC is also a connectionless protocol and uses an arbitration sequence (not CSMA/CD) to ensure access before transmission.

As with all networking, Fibre Channel too is defined in layers, here labeled FC-1 to FC-4, which range from a definition of the physical media (FC-1) up to the protocol layers (FC-4) which most importantly includes SCSI, the widely used disk interface. This is key to its operation in storage networking.

For further information, see http://www.iol.unh.edu/training/fc/fc_tutorial.html and http://www.t11.org/index.htm

*ATM.* Asynchronous Transfer Mode (ATM) provides excellent, if expensive, connections for reliable transfer of streaming data, such as television, with speeds ranging up to those of telecom backbones (10Gb/s). It is mostly used by telcos. Those most appropriate to TV operations are 155- and 622Mb/s. Unlike Ethernet and FC, ATM is connection-based. A path is established through the system before data is sent. A strong point is its Quality of Service (see later).

There are sophisticated lower ATM Adaptation Layers (AAL) offering connections through the network on which higher layers of the protocol run. AAL1 supports constant-bit rate, time-dependent traffic such as voice and video. AAL3/4 supports variable-bit rate, delay-tolerant data traffic requiring some sequencing and/or error detection. AAL5 supports variable-bit rate, delay-tolerant connection-oriented data traffic requiring minimal sequencing or error detection support. This is often used for general data transfers.

See http://www.atmforum.com/

*IEEE 1394.* IEEE 1394, branded as Firewire by Apple Computers and I-Link by Sony, is unusual. It provides both an asynchronous (no guarantee of time taken — like Ethernet) and isochronous (guaranteed within a time frame — like some ATM) data transfer modes. This is because it is aimed at AV applications and is widely used in prosumer and consumer products.

It runs at 100-, 200- and 400Mb/s, is simple and cheap to plug together and uses an arbitration technique to access the bus bandwidth between connected devices. However, it is currently restricted to short cables of 4.5m or 10m maximum. The upcoming IEEE-1394b standard offers higher speeds and longer cables (see Future).

See excellent article at http://www.computer.org/multimedia/articles/firewire.htm

And http://www.zayante.com/html/IEEEinfo/IEEEcom.html

*IP.* The network protocols carrying the data lie on top of the physical networks and connections. Of the many, attention is focused on two types – IP, the defacto standard, and other protocols that run on Fibre Channel.

Internet Protocol (IP) is the most widely used protocol in IT. Besides its Internet use it is also the main open network protocol that is supported by all major computer operating systems. IP, or specifically IPv4, describes the packet format for sending data using a 32-bit address to identify each device on the network with four eight-bit numbers separated by dots, e.g 192.96.64.1. Each packet contains a source and destination address.

Above IP are two transport layers: Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). TCP provides reliable data delivery, efficient flow control, full-duplex operation and multiplexing (simultaneous work with many sources and destinations). It establishes a connection and detects corrupt or lost packets at the receiver and re-sends them. This TCP/IP is the most common form of IP. It is used for general data transport but is slow and generally not ideal for video.

UDP uses a series of "ports" to connect data to an application. Unlike the TCP, UDP adds no reliability, flow-control or error-recovery functions, but it can detect and discard corrupt packets using checksums. Because of UDP's simplicity,

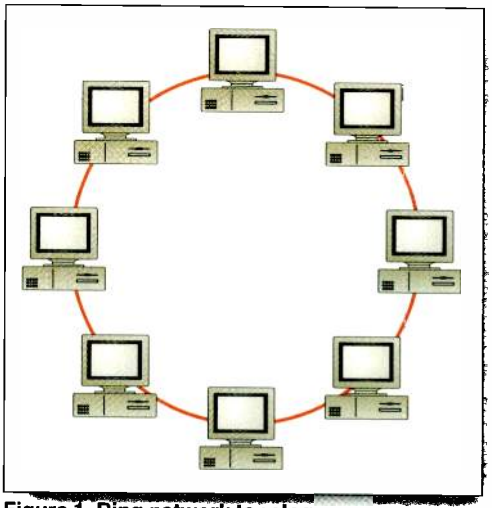

Figure 1. Ring network topology

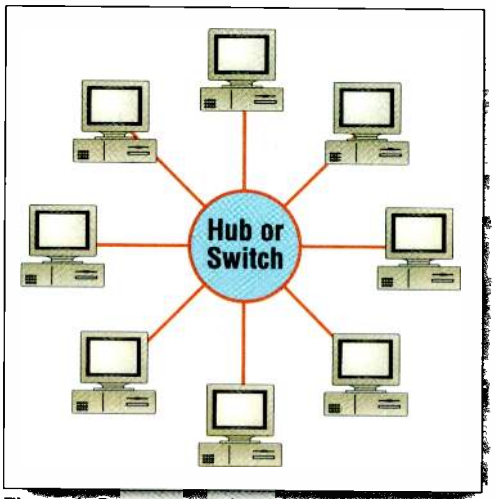


Figure 2. Star network topology


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its headers contain fewer bytes and consume less network overhead than TCP. This makes it useful for streaming video and audio, where provision of a continuous flow is more important than replacing corrupt packets.

There are various other IP applications that live above these protocols such as *File Transfer Protocol (FTP), Telnet for terminal sessions, Network File System (NFS), Simple Mail Transfer Protocol (SMTP)* and many more.

Other protocols, such as SCSI, are often mapped onto networks, such as Fibre Channel, to act as a protocol layer. The aim is to carry a protocol targeted at a specific function — disk interfaces in the case of SCSI — over the network at maximum efficiency. This is why FC-SCSI is so important to storage networking. IP is a general-purpose network protocol designed for any application. This flexibility means it is less efficient than the targeted mappings.

### Networks topologies

Today, most networks are connected in a star configuration with connections to the various networked devices radiating from a central unit, hub or switch. Some networks, notably Fibre Channel, can be arranged as a loop of devices. Figure 1 shows a ring topology.

Stars offer the benefits of easy removal and reconnection of devices, fault isolation and, given the right network devices, they can be faster than ring topology. Interestingly Fibre Channel devices are usually arranged as a star (not ring) for these reasons. Figure 2 shows star network topology.

For more information on topologies, see http://www.techweb.com/encyclopedia/defineterm?term=topology

### Infrastructure devices

Devices arranged in a star need to connect with a network device in the middle. There are three general types. The most basic are hubs. How these work differs for each of the network types and some, such as ATM, do not support hubs. Ethernet hubs terminate and repeat the signals from one network spoke onto all the others — so all connected devices see all network traffic. For Fibre Channel, hubs make it easier to add and remove devices from their arbitrated loop.

Switches (also called fabric switches) are far more intelligent. They inspect the destination address of each data packet and, knowing the locations of all devices, send it down the appropriate spoke. This gives a massive performance improvement, as traffic not meant for a device does not clog its spoke's bandwidth.

Switches have fast hardware for packet inspection as well as a huge back plane bandwidth to send all the traffic to the correct ports. They are measured by their packet-per-second routing capability and the bandwidth of their internal switching back plane. Wire speed, or non-blocking switches, pass all network data without missing anything. Many such switches exist today for the high-speed networks used for television.

Routers or gateways can be combined with switches. A router handles the packets that need to pass from one network to another. For instance, if your plant had a LAN that wanted to connect to the Internet, it would use a router.

### Types of transfer

There are several ways data can be transferred between devices over networks. Here, without referring to protocols, the approach of three "transfer styles" is reviewed.

Using an IT-style transfer, nothing can be done with the file by the receiver until the transfer is completed. This is not normally a problem for smaller files and documents but for large video or audio files it may cause a serious delay. So some broadcast manufacturers provide "broadcast" file transfers allowing file access as soon as the transfer starts. This allows editing or even playout of a file during transfer. These are proprietary systems but nevertheless very useful.

The other method of AV transfer, especially suitable where the receiving device wants to play the information soon, is streaming. Here data is sent as a continuous stream, often without error correction, at a constant data rate. Streaming is similar to an SDI connection but may have a large variable delay.

### Quality of Service

The broadcast industry grew up on reliable connections — via a patch panel or router — knowing that the video/audio will get through this dedicated connection instantly. Heaven forbid that someone else should even think of muscling in on the same cable! Welcome to networking.

Network switches can ensure that the data goes from one source to another but there may still be bottlenecks where traffic shares a single connection between two areas or switches. This traffic aggregation is one of the benefits of networking, but if too many streams try to use one connection something suffers and in video that means missed frames. It is a triumph of marketing over adversity that this problem is referred to as Quality of Service (QoS). To be fair, it usually means definable or good QoS, but it highlights that care is needed.

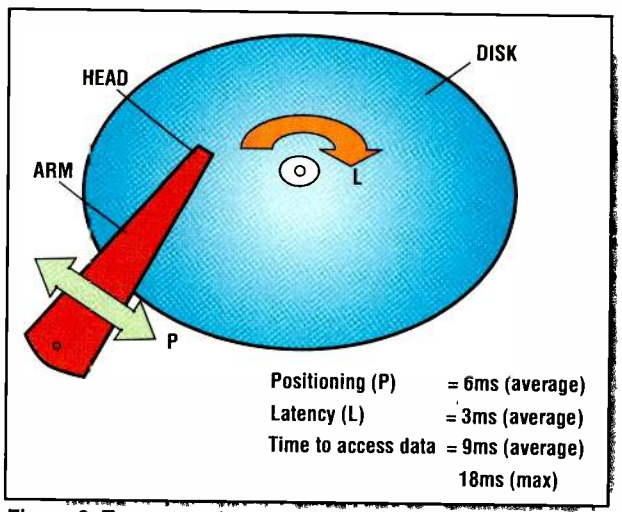


**Figure 3. To access data, a disk drive must spin to its start, position its arm on the correct track and then read the data.**

ATM was designed with QoS in mind and does this job well, allowing detailed characteristics to be set for any connection. In contrast, IP is having QoS grafted on and it has taken some time for this to be generally implemented. Even now, most IP networks have no built-in global QoS, although it can be done.

There are three defined levels of QoS in IP: Best-Effort, Integrated Services (IntServe) and Differentiated Services (DiffServe). ATM has its own QoS defined by the AAL layer definition.

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Best Effort/AAL-5, is self-explanatory and is what you get with most Ethernet-based networks. There are no guarantees on data delivery or bandwidth and all traffic has equal access to the network. In overload conditions data is either delayed or lost and has to be retransmitted. IntServe/AAL-1 provides applications with a guaranteed level of service by negotiating the required bandwidth across the network between the two ends that want to communicate. But DiffServe is more popular. It classifies IP data so that higher priority-traffic is given preference over lower-priority traffic—which may get delayed/lost in busy periods.

## Disk storage

Storing video and audio on computer disk drives is common today. It would be easy to assume that is it better than tape, which it is in many respects. A more accurate view is that it is different from tape – not everything is positive and there are limits to disk-based performance. One huge advantage is that disks allow breaking away from the rigors of totally real-time operation, making possible video operation with IT equipment.

Unlike tape, disks provide random (nonlinear) access to storage, millions of accurate read/write cycles without any deterioration and, being digital, their fidelity is assured. Well-known downsides are that they are usually not removable, they are susceptible to shock damage and they are limited in capacity due to relatively high costs compared with tape.

However, there remain some fundamental barriers that can mainly be attributed to applying a computer peripheral to television. Computers generally require short bursts of data, files of a few kilobytes, from disks. A single channel of uncompressed eight-bit SD video requires 21Mb/s (31MB/s for RGB) continuously for the whole length of the item – which may be hours. It is only within the last year that a single drive has become available to sustain such performance (not for HD, which requires over seven times the data). Also, there needs to be some failsafe protection and, in editing, more than one video channel is desirable.

The solution is to group drives and aggregate their performance. Usually this is done with a redundant array of individual (or inexpensive) disks (RAID), which also offers data protection, should a drive fail. There are many configurations, or levels, but RAID 3 is usually accepted as most suitable for real-time video. To provide the continuous data speeds required, these are not off-the-shelf items but are specifically designed for video. Such RAIDs may be used as stores for stand-alone systems, such as edit workstations, or as storage blocks in SANs.

Such stores offer performance tailored to needs. Maintaining a flawless 24-hour, high-level performance is not straightforward, as the fundamentals of disks impose limits.

Disk drives have fewer moving parts than VTRs - only two, the disk platters themselves and the arm used to position the read/write heads. (See Figure 3.) A modern high performance drive spins the disks at 10,000RPM, taking 6ms/revolution. To access required data the disk must spin to its start – an average of 3ms (latency), and the arm must be positioned over the correct track – this positioning time averages about 6ms (worst case edge to center ~ 15ms, best is between adjacent tracks – 1ms). Having all the video data held on adjacent tracks is most efficient but, as work progresses, with deletions and new recordings, the data becomes progressively fragmented around the disk and access times increase. This leaves less time to read the data and the data rate suffers.

Video servers that stream only long clips of video, such as in transmission playout, may record most or all of their material on contiguous tracks and replay them in the same order. But those working with editing workstations need to randomly access down to frame level, preferably in real time, causing the store to rapidly fragment. Interestingly, analysis shows that a single server store, using disks as above, is limited to around 20 simultaneous real-time random access video channels as the access time, not the bandwidth requirement, maxes out the performance. Although you may consider this is a harsh requirement, it illustrates that there are limitations to disk-based performance and fragmentation remains an important issue. However, if servers are to maintain continuous 24-hour performance, stores will eventually fragment and there may be no time to defragment them. However some do run defragmentation routines when the workload allows.

There are two basic types of storage applications. The first is for the record and playout of long-form elements with limited or no editing – as in the transmission example above. This typically would rely on compressed video – up to 50Mb/s per channel (compatible with IMX and DVCPRO50 VTRs). The second application focuses on editing where uncompressed video at 21- or 31Mb/s per channel is needed. Multiple channels of real-time random access to every frame are often required here.

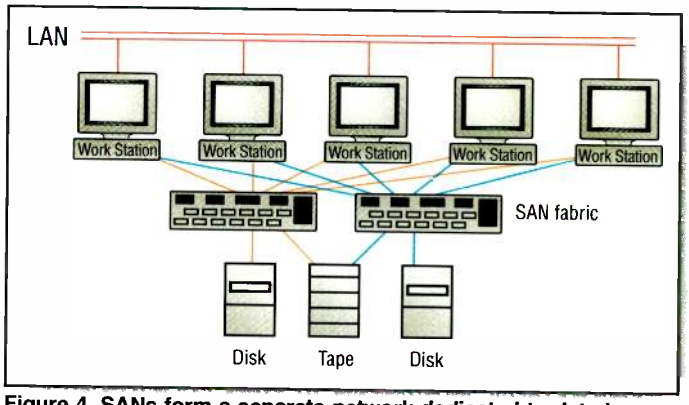


**Figure 4. SANs form a separate network dedicated to data-hungry workstations.**

Making a store work requires much more than the disks. You also have to provide some form of database management to keep track of where all the clips, or even individual frames, are stored and some thought is needed as to the interface to the outside world. Sometimes the latter is presented as an IT-style network connection, sometimes as TV-style SDI or SDTI and sometimes both. Running a server multiplies these needs. For instance, a server providing 20 real-time connections must run at 20x speed in all respects – including database and

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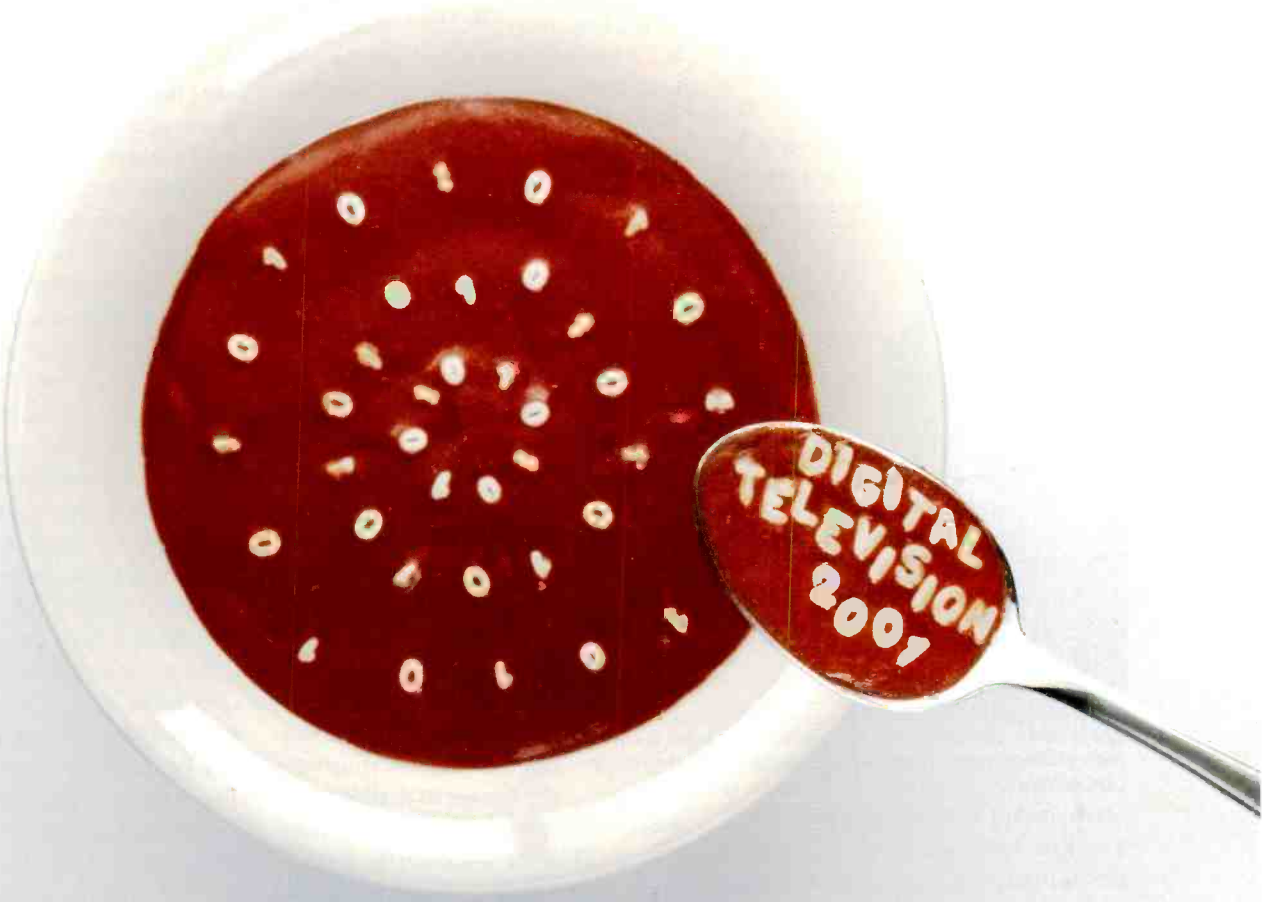


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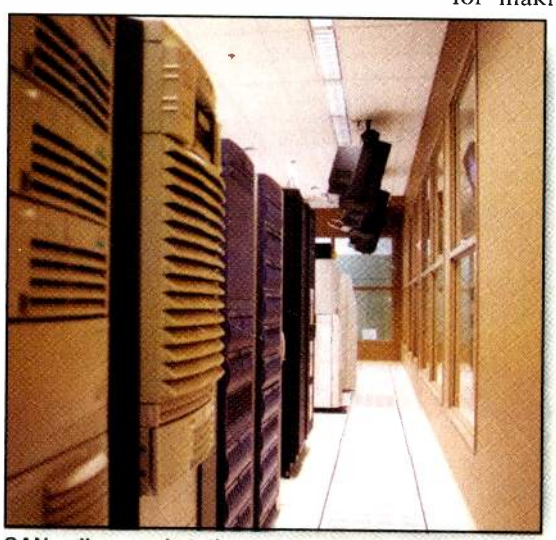
data bandwidth access. A telling test is to verify that all the listed connections can all run together!

### Storage networking

Networking is closely associated with storage – where else does all this data come from? In particular one network technology, Fibre Channel, has a particular role in storage networking. See http://searchstorage.techtarget.com/bestWebLinks

Desktop computers provide the most basic form of network storage, with the ability for one machine to make its local disk visible to other computers via a network – usually Ethernet. This is very useful, allowing transfers between machines, but it is not what is really meant by storage networking. The first level is a server that uses a general-purpose computer to provide storage that workstations can access. These can range from old PCs recycled as servers using Linux and Samba software right up to multi-processor PCs or Sun servers with RAID controllers connected to a large group of disks. Other tasks may be handled as well, such as running the centralized mail or handling some networking tasks. There are no fixed rules.



**SANs allow workstations to access data from a common storage pool. Photo courtesy Doyle Technology Consultants.**

Network Attached Storage (NAS) describes a dedicated file server. It differs from general-purpose servers in that it runs a stripped-down operating system and its sole job is to provide network storage. It runs over existing networks and so may well be unsuitable for data-intensive applications such as video. See http://www.techweb.com/encyclopedia/defineterm?term=NAS

Storage Area Networks (SAN) are a whole new ball game, especially with regard to networks. Their importance is huge as now they are the most common method of providing shared video storage. The design recognizes that moving large amounts of data is inconsistent with normal network general data traffic. SANs therefore form a separate network dedicated to connecting data-hungry workstations to a large, fast array of disks. (See Figure 4.) While SANs could use any network technology, Fibre Channel predominates. Its 800Mb/s data rate and disks with direct FC connections are ideal for making large, fast storage networks. In practice, basic networking and storage networking are used side-by-side to offer wide scope for sharing and transferring material. Besides disks, essential items are FC switches (if FC is used to connect storage) and software for file sharing and management. See http://www.techweb.com/encyclopedia/defineterm?term=SAN

Exactly how SANs are applied varies among broadcast manufacturers (see later), but they often provide the storage to double up, or totally replace workstations' local video storage. Thus the workstations can operate directly from a common, shared storage pool. Not only does this promote work sharing but it also leads to other efficiencies such as eradicating the dead time required to load new material. This can now be laid-off from the main editing areas to a dedicated loading station. Backups can become more straightforward too.

### Video servers

The prime aim of a video server is to supply multiple channels of real-time video, often via SDI or SDTI connections. Even so, no video server can ignore network connections. GVG's Profile, one of the earliest systems, uses Fibre Channel to allow files to be copied between Profiles and third-party access. Avid's Pluto server AirSpace has a Gigabit Ethernet connection, as does Quantel's Clipbox systems. Besides offering direct connections with IT-based equipment these may allow faster than real-time transfer of files with third-party applications.

### Performance

Between the networking and storage there are a large number of elements all, hopefully, working together. The whole ethos of networking is sharing, so predicting performance is not straightforward unless specific steps are taken to take charge of capacity — going against the ethos but guaranteeing performance where it is needed.

A chain is only as strong as its weakest link, so every step of a network needs attention. Starting with the disks themselves, a modern high-performance drive may quote an average data transfer rate of around 30Mb/s but this is not constant. The data rate from near the circumference is considerably greater and that from near the center is much less. Also, since constantly high data rates are required, time taken to make random accesses significantly affects data delivery. A good design will add drives and management to ensure required specifications are met.

The use of non-blocking switches and QoS features does not mean that the workstation performance on a network will be anywhere near its wire speed. The problem is complex, depending on the physical network characteristics, the protocol used, the Network Interface Card (NIC – or Host Adapter) and the workstation power. For instance, Fibre Channel excels in SAN systems because mapping SCSI protocol onto FC works so well and, with an NIC tuned for SCSI, performance near FC wire speed is possible. However, run TCP/IP instead of FC-SCSI and performance drops dramatically.

Conversely, Gigabit Ethernet is mainly used with TCP/IP, so the NICs and the workstation software are tuned to this, making it much faster than FC-TCP/IP. However, performance is far short of the 1Gb/s Ethernet wire speed. Due to the small data packets and the overheads of the TCP/IP protocol, around 400Mb/s is reported on a modern PC/NIC. Also, the quality and

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power of the NIC will determine how much load is made on the processor to handle the network data transfers. Even so, real-time performance at SD is achievable with Gigabit Ethernet if the system is put together with care.

End-to-end system operation under normal working conditions gives the only true measure of performance. The network, protocol, server, switch, NIC, workstation processor power and the application are all parts of the puzzle. The numerous items, many incompatible, come from different suppliers, which means only a highly skilled IT workforce has any chance of building a system. For this reason many broadcast suppliers provide a one-stop-shop approach to their systems and the associated networking. Although this removes the chance of an open choice of components, it does provide a complete solution.

## Practical issues

Ultimately the systems have to work in busy, pressured operational environments. There are more issues to consider. For example, when was the last time your SDI router failed or a VTR broke? How long did it take you to get something working again? What were the consequences of the failure – bad and maybe job threatening? Networks and disks are more complex than SDI routers and very different from VTRs. It is likely they will fail and, possibly, in more complex ways. The good news is that solutions exist to make your network and SAN 100 percent reliable – but at a price. The bad news is that the complexity rises with every extra piece that you add. It may be reliable, but does anyone understand the system anymore?

What about support? Analog video and SDI are well understood, but who can talk TCP/IP subnets, RAIDs and black-and-burst? Support staff needs to understand video as well as solve network and storage problems. The job just got a whole lot more interesting – or difficult. For some systems, especially SANs, the network can be considered as a separate unit, which often makes support easier.

Upgrading is important, but can parts of the network be upgraded while it is on-air? This could be helped by compartmentalizing the networks in the same way as SDI routers do today. This helps maintenance, support, reliability and ease of installation.

## Available systems

Looking at the offerings from a few manufacturers illustrates what can actually be done with the technology today. As the latter is moving fast, this is only a snapshot in time so expect things to be different tomorrow.

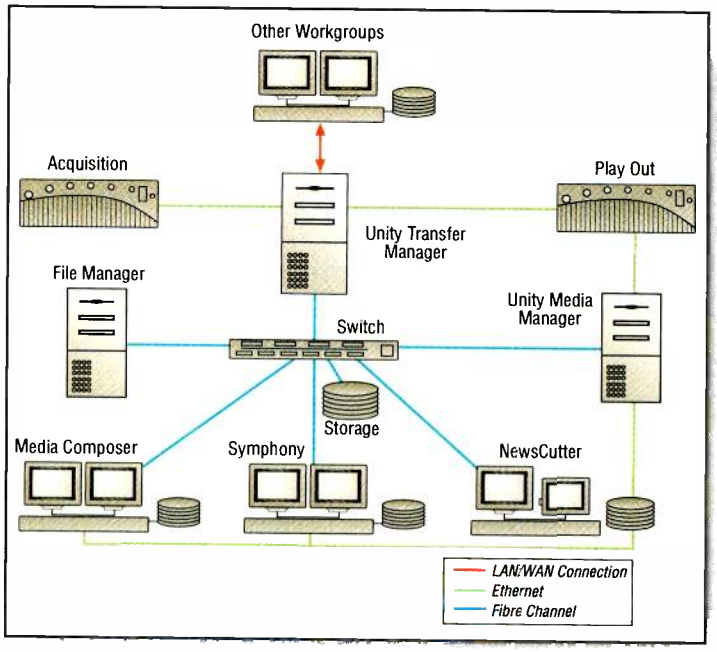


**Figure 5. Avid's Unity MediaNet SAN-based system**

The sharing of work is clearly useful in areas such as news, sports, editing and post production. Although these are prime targets for companies offering systems that connect their products together, servers are most commonly found in transmission/playout areas.

***Transmission/playout.*** For most broadcasters, revenue depends on the successful airing of commercials. Video servers are rapidly displacing cumbersome tape cart machines in this area. These are handling compressed video and are not expected to create edits. The former reduces the data rate and the latter means that files can be stored in groups of pictures, rather than the picture-per-file basis needed for editing – thereby reducing the database management overhead.

Transmission is a popular application for Omneon's Network Content Server. In the Omneon product, two stores provide 80 hours of material at 25Mb/s (other bit rates can be used) with Fibre Channel connections to the Director. Somewhere, systems using disk storage – which is file-based and asynchronous – have to make the video data fit with television's regular line and frame rates – which are synchronous. Omneon chose 1394, as it allows attaching synchronous equipment to a file-based world. The Director interfaces between the Mediaports and the file system. The Mediaports translate the 1394 data into video, audio and data (carrying all three on one connection saves cabling) for the various video applications. Mediaports are not always required. The 1394 can connect directly to video applications such as a FAST purple. NLE. The system is expandable with more storage, 1394 connections and Mediaports.

Above all, the need is for reliability and so, although there may be spare bandwidth – or even actual SDI connections – on production servers, typically the on-air device is kept separate. This is to maximize reliability and avoid being blocked out by other demands on server bandwidth. A different approach is offered by SGI, where their Guaranteed Rate I/O (GRIO) ensures that a designated area of their SAN always has sufficient resources guaranteeing its bandwidth at all times. While not offering any form of equipment redundancy, this approach may be attractive to some as it also offers rapid transfers to the transmission area from adjacent storage.

***Post production.*** Avid and Discreet offer server products for editing and post production. Here, the need is often for dual-channel support for a number of editors with real-time uncompressed video, which makes heavy demands on bandwidth. Avid's popular Unity MediaNet SAN-based system (see Figure 5) uses Fibre Channel-connected disks and supports up to 25 dual-stream clients

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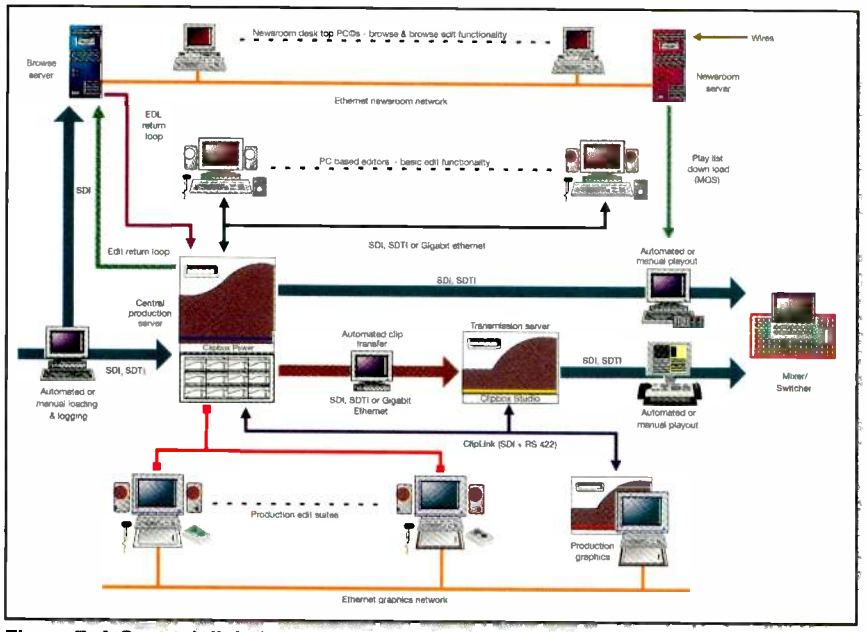


**Figure 7. A Quantel digital news production system**

over a wide variety of Avid products. While the server provides work sharing, system management also makes a big contribution. For example, the Unity Administration tool creates dynamic virtual storage so the SAN space may appear as a single "disk" of 7.3TB or many disks allocated to each workstation. Should one need more space, a suitably privileged user can re-allocate any surplus from one workstation to another to make the most efficient use of all available space. For more information on Avid's Unity, see http://www.avid.com/products/unity_medianet/index.html

Discreet has a SAN, Stone and Wire, for its high-end systems. This combines a Fibre Channel-connected storage system, Stone, with a HIPPI-based client-to-client network connection, Wire. The new jobnet pro offers a SAN environment for up to 10 NT-based edit workstations with dual-stream uncompressed video supplied directly over Fibre Channel. Maximum storage is 7.7TB, or 108 hours. Figure 6 shows a quite typical mix of FC-connected SAN and 100Mb/s peer-to-peer Ethernet. As with many systems, tasks are divided and here jobnet producer software runs on a PC to provide browse-level functions such as shot logging, storyboard editing, approval, etc. See http://www2.discreet.com/products/d_products2.html?prod=infrastr&cat=storage

These systems are proprietary. Open systems do exist that make a shared SAN appear to be just another disk on a workstation. However they are not in widespread use in the editing arena, partly because of the service and support issues of a mixed-supplier environment.

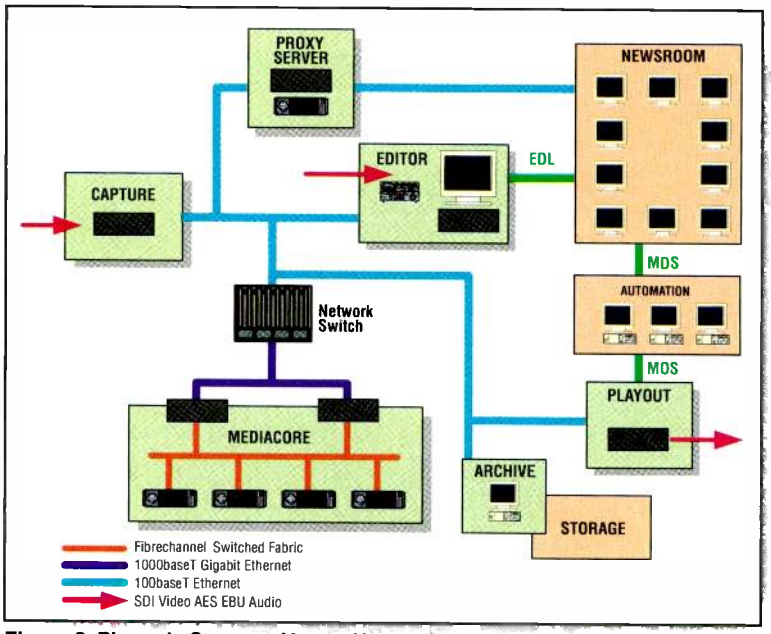


**Figure 8. Pinnacle Systems Vortex Networked News**

Where there is 3D animation, shared storage is obviously present but the demands on the system are lower than streaming video. Good quality networking such as 100Mb or Gigabit Ethernet can handle such systems.

*News.* News is the harshest broadcast environment for servers. There is a constant flow of material progressing through the system with many workstations involved – nearly all of which want access to the video, audio and text for the journalists. Graphics are also involved. Work is highly parallel – many people working at once, possibly on the same story. Finally the material has to be played to air. The period up to on-air time is always frantically busy with many demanding instant access to everything. Finally there is playout into the bulletin. Much of video server system design is about supplying adequate bandwidth and the removal of bottlenecks. Any shortcomings will be noticed, as the whole system has to operate smoothly under extreme conditions that occur every day.

Of the over 100 workstations that may need to share the video, most are for journalists whose needs are met with compressed versions of the clips for making their edit decisions. Quantel's digital news production system (see Figure 7) often features two separate networks, the Ethernet serving the journalists' stations with browse-quality video and audio from the browse server, and another buried inside the Clipbox Power (central production) server, providing the broadcast quality material. The latter is a SAN system-in-box structure with no FC but an extremely fast internal bus connecting its RAID storage and presenting 14 editable SDTI channels (the production edit suites operate directly on the server store) and 1Gb/s Ethernet to the edit stations and other

news facilities. Figure 7 shows a full news system. Note the use of a separate server for transmission, with backup from the production server.

Pinnacle Systems VorteX Networked News solution (see Figure 8) uses a SAN-based FC-connected MediaCore as its main shared storage but breaks out from that with Gigabit or 100Mb/s Ethernet. Using standard, but tuned, TCP/IP (achieving 70Mb/s payload data over 100Mb/s Ethernet) significantly reduces infrastructure costs (vs. Fibre Channel) and yet achieves the required broadcast quality performance with DV or MPEG compression. The 1Gb/100Mb Ethernet mix can be varied to suit specific requirements. Here again, there are several networks employed: the SAN storage, broadcast-quality equipment and browse "proxy" quality for the many journalist workstations. Much of the equipment uses standard IT platforms following Pinnacle's open technology principles.

See http://www.pinnaclesys.com/docloader.asp?templ=7&doclink=/bsd/solutions/networkednews/doc/index.html

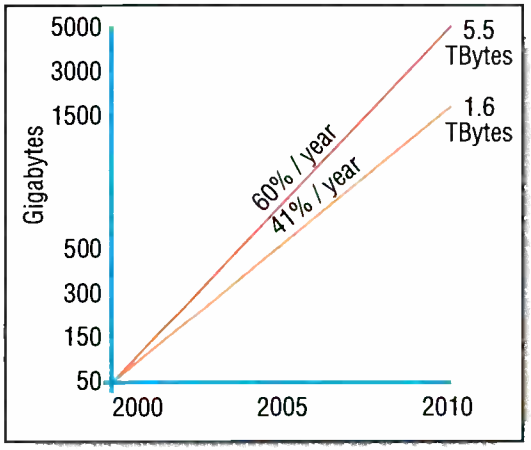


**Figure 9. Single disk drive capacity increase to 2010 at 40 and 60 percent**

## Future

The technologies employed in networking and storage networking are rapidly developing. Such changes are bound to boost the efficiency and performance of networking and storage.

***Disks.*** Disk drive capacity has always been cited as a limitation but its importance continues to recede. Historically capacity has doubled every two years (41 percent pa), but recent development has been nearer 60 percent pa. (See Figure 9.) Current in-use drives are up to 73Gbytes (approx. one hour of uncompressed SD) but 180Gbytes is already available.

HD imposes roughly seven times the demand for data (~560GB/h), yet disk stores have already been built to provide dual-channel, uncompressed support. Such rapid progress ensures that disk-based stores will increasingly dominate television operations into the future.

Much of the increased storage capacity comes from increasing the track density (TPI, tracks/inch: 18,000) and recording density (BPI bits/inch: 342,000) the linear data density along the tracks, making an overall gain in area density (figures shown for a high performance 73GB drive). Even the compact 1.6-inch high, 3.5-inch drives may have as many as 12 stacked platters. Note that increases in recording density affect both capacity and data rate. Another way of augmenting data rate is to increase the RPM – spindle speed. Currently 10RPM is fast and there are some 15,000RPM models available. Faster rotation also reduces the latency – in turn reducing the time taken to reach required data. Despite the pitch to which drives have already progressed, this pattern of development is expected to continue towards 2010.

***IP.*** The 32-bit address space of IPv4 is not enough to support future development, and workarounds are already in use. The Internet Engineering Task Force (IETF) proposed a new standard, IPv6, in 1998. This massively expands addressing capabilities from 32 to 128 bits. There is also better QoS with a new implementation of DiffServe. Authentication, data integrity and confidentiality are supported and the handling of common packets becomes easier and faster. There are also extensions to multicast and multi-homing IP addresses.

The change to IPv6 may well be driven by telcos, as the European 3G cell phone system requires two globally unique fixed IP addresses for each mobile device to be provided via IPv6.

***Gigabit Ethernet and IP.*** The commodity Ethernet products running the open standard protocol IP do a great job but presently cannot provide reliable high performance networking for multiple uncompressed SD or HD video streams. This will change. Again, the mighty Telecom market sees packet switching networks and IP as the way to go. They need multi-vendor working QoS solutions to get voice, and ultimately video, reliably through their systems. Sources say this goal is close.

The IT sector uses IP, and demand for bandwidth and data is growing. Top-end NIC cards are offloading ever more of the IP protocol handling to improve network performance and lighten the load on the workstations' processors.

10Gb/s Ethernet is around the corner, with initial use expected to be for switch-to-switch interconnects. NIC cards for high-end servers will offload most of the IP protocol as Ethernet packets arriving every 1.2µS present far too heavy an interrupt load for a processor doing other work.

***IEEE-1394b.*** Networking is encouraging but it focuses on files and storage. What about live TV? Can cameras and vision mixers ever have their synchronous SDI replaced by a network connection?

IEEE-1394a with its isochronous transfers has guaranteed delivery and timing. The upcoming IEEE-1394b with longer cables (100m over fiber) may offer a new option for broadcast. The current 400Mb/s is fine for SD video and compressed HD but 1394b defines 800Mb/s and 1.6Gb/s rates — covering HD in all its current forms. IEEE-1394 is one to watch.

Although "IT-based" and "open" are often taken as synonymous, this is hardly the case with storage networking. Self-built SANs are not easy, so many wisely chose proprietary offerings. However, connecting to someone else's Fibre Channel is not the same thing as plugging in SDI. Maybe it will happen by default but there is a definite need for standards to truly open up this technology to the television industry. ■

*Bob Pank is a television industry journalist. He can be reached at bob@pank.demon.co.uk. Jon Smith is principal consultant for Three Steps Forward Ltd. He can be reached at jon.smith@threestepsforward.com.*

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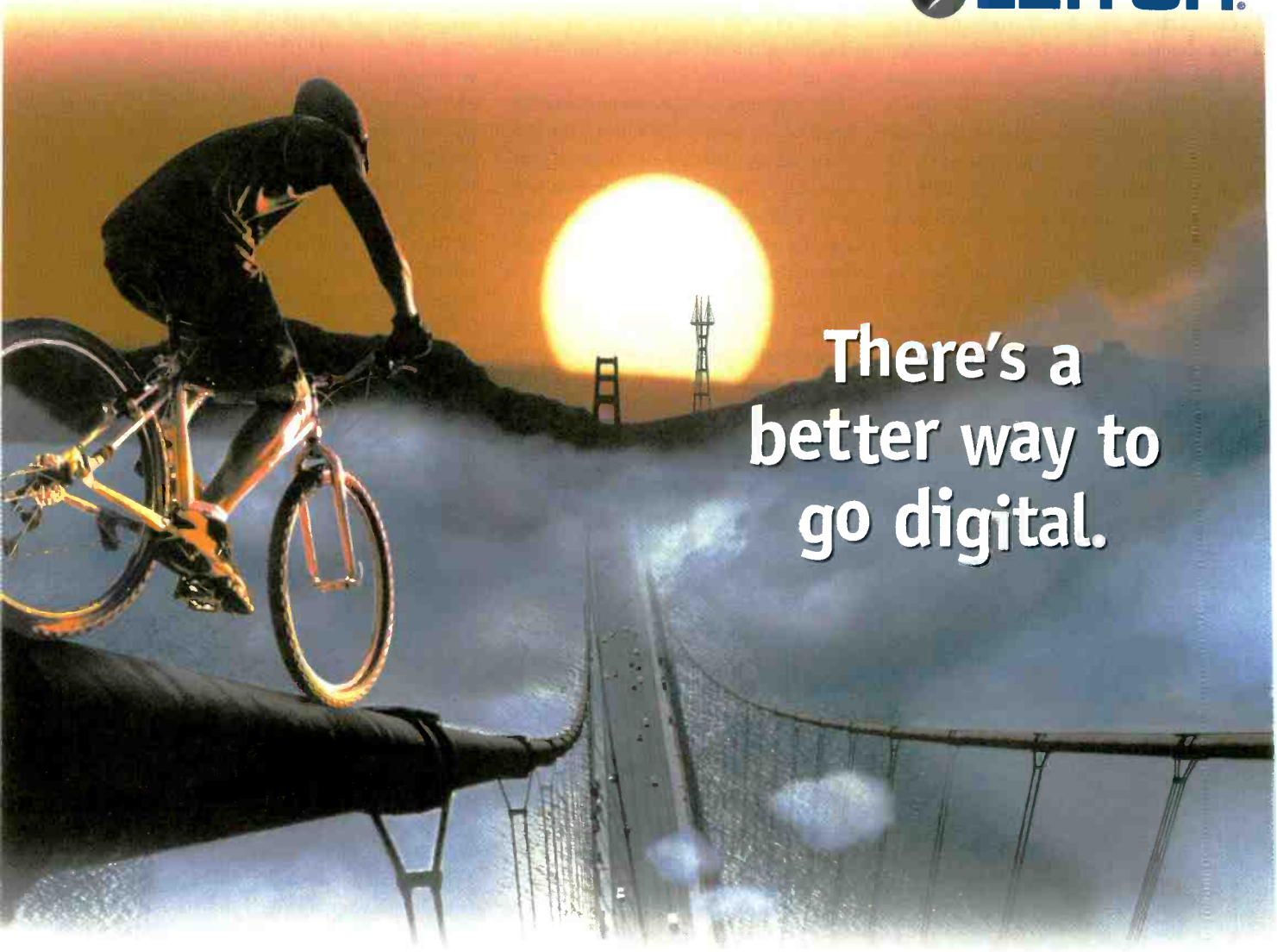


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# Tower lighting

BY DON MARKLEY

Tower lights are a lot like air conditioners in that we tend to only pay attention to them when they don't work. However the station chief operator, by regulation, is responsible for seeing that the technical operation of the station is in compliance with the Commission's rules and regulations. That obviously includes seeing that the tower lights are on and operating normally every day.

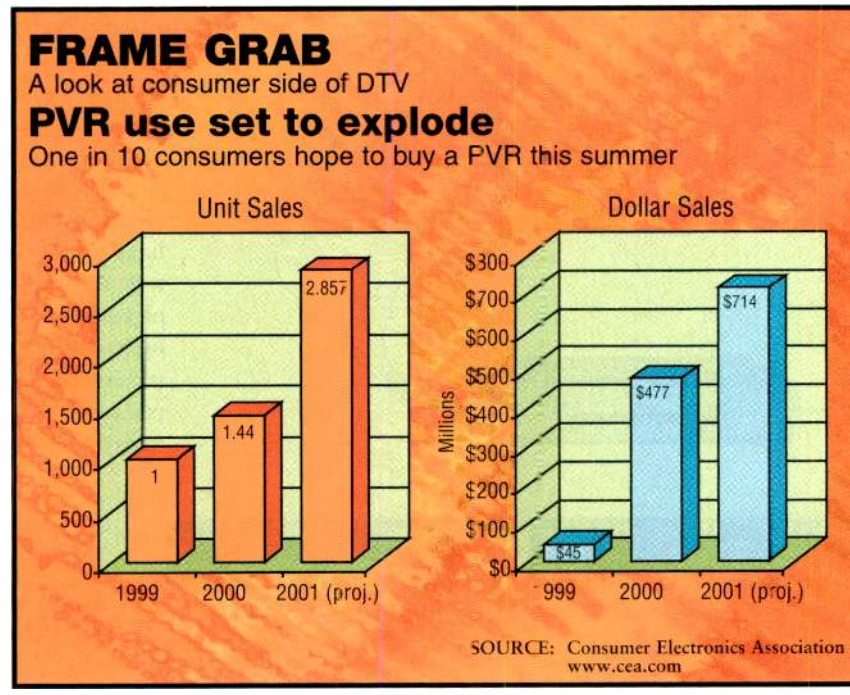
One document that every station should have on the shelf is an FAA advisory circular identified as AC 70/7460-1K, titled "Obstruction Marking and Lighting." Of particular interest is the section covering light failure notification. Basically, any failure that lasts more than 30 minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to the nearest FAA flight service station (FSS). That office will then issue a Notice to Airmen (NOTAM) to be given to all pilots that call in for a briefing. In reality, probably no one will hear about it, but you have to make the notification to take the liability away from the station.

If you can't find the number for the flight service station, you can check the FAA Web site at www.faa.gov/ats/ata/ata400. Steady burning side light failures don't have to be reported to the FAA but are expected to be repaired in a timely fashion.

Your notification must include the name and contact information of the person making the report , the type of structure, the location of the structure, the height above mean sea level and ground level, an anticipated date for return to service and the FCC antenna registration number. To make this a realistic chore, the data should all be looked up in advance and posted where the on-duty operator can simply make the call and insert the light that is out of service. Be sure to get the name of the person taking the call, and then log the time and date of the call, the name of the person making the call and the name of the person who took the call. It is not unheard of for the FAA to drop the ball and not prepare the NOTAM. If a 747 modifies the station's tower height, the finger pointing will be greatly facilitated if your log entries show that you met the necessary requirements.

**Dual lighting systems avoid the necessity of painting the tower but are much better neighbors at night.**

Now, a review of the basics for tower marking. Unless the tower is lighted with high-intensity flashing white lights (high-intensity strobes) or medium-intensity strobes, it must be marked. Towers up to 700 feet should have seven evenly spaced bands; towers from 701 to 900 feet need nine bands; towers from 901 to 1100 feet need 11 bands and taller towers require 13 bands. Normally, a top-mounted television antenna is included in the height of the structure and should be colored accordingly, usually orange. If the height of a painted tower is changed significantly, as when a top-mounted antenna is removed, the rules would normally



**Tower owners bear the responsibility for proper notification during tower lighting outages. Photo by Chriss Scherer.**

call for repainting so that the bands of color remain evenly spaced. However, the FAA will usually permit a station to retain the existing color bands until such time that the entire tower is to be repainted. The spacing of the bands should be corrected at that time.

The tower lighting and marking is the responsibility of the owner of the tower. If the tower is shared, a written agreement can be made between the parties involved as to whose responsibility it is to monitor the lights and to decide when it must be painted. The Commission's examiner will have a chip chart that will allow the paint to be evaluated. If too faded, a citation will result. Simple practice dictates that the tower colors will probably be acceptable as long as the tower paint is in good condition. Solution, when it looks lousy and rust is starting to show up, paint it.

To review, there are three basic types of lighting systems. The first is conventional red lights. Painted marking is always required with these.The next level would be medium-intensity flashing white obstruction lights. They may be authorized on towers up to 500 feet AGL and will normally be at full intensity during daytime and twilight hours and at reduced intensity during nighttime hours. The third basic system is high-intensity flashing white obstruction lights that operate at full intensity during daytime hours, reduced intensity during twilight hours and even further reduced intensity at night.

The only time that high-intensity strobes are normally required is on structures over 500 feet. In addition, the FAA will often permit dual lighting systems where medium- or high-intensity strobes are used during the day and twilight hours and conventional red lights are used at night. That type of lighting system avoids the necessity to paint the tower but is a much better neighbor at night. In many areas, the zoning regulations require dual lighting unless the FAA absolutely insists on high-intensity strobes at all times. A station can count on complaints from the neighbors if high-intensity strobes are used. These complaints increase dramatically when the controller fails by keeping the lights on at full intensity at night. Nearby residents will then be able to read, albeit in short bursts, by the light of your strobes — inside — with the drapes pulled — under the bed. ■

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

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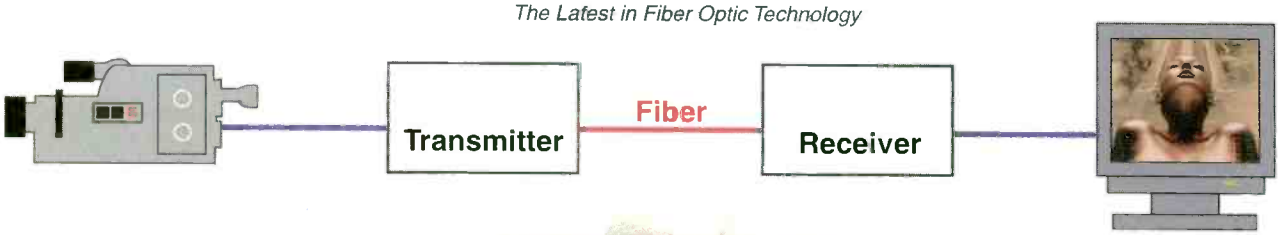


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# DAWs for video

BY RANDY ALBERTS

Opening an extra audio post suite? Extending the audio services of a television edit studio? Are you building a top-notch surround facility from the ground up? If you're looking to buy, you're likely considering a digital audio workstation (DAW) to turn square footage directly into plowshares — and as well you should. Processor chips and the average computer are more powerful than ever before, and even today's more-affordable DAWs threaten the audio specs of high-end consoles, effects processors and digital tape recorders that cost ten times as much not so very long ago.

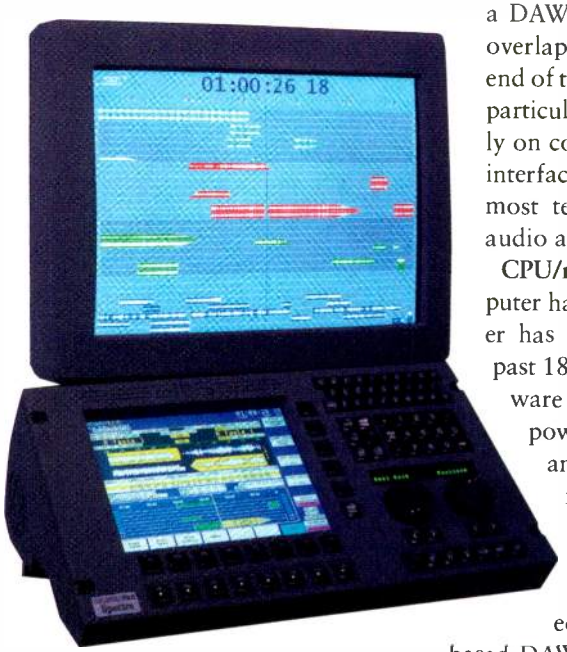
The sound-for-picture, post, radio and music markets have embraced computer tools like never before as well, and the available audio toolboxes get bigger at every trade show. Avoiding the "upgrade-itis" endemic to computer and DSP chip technology every year or two is easier to do if you spend enough time planning your studio's future. Think about your current client roster and the kind of client mix you'd like to have in the next year and a half. Accurately predict the services you'll offer them in that time and beyond, and you'll end up looking like a digital Nostradamus with your DAW choice.

**If seeing OMF, MADI, ADAT, DEVA, LTC and VITC all in the same sentence gets you excited, you've been in the studio too long.**

## A brief DAW spec sheet

What exactly is a DAW? From $1500 stand-alone personal digital studios to $5000 PC- and G3-based desktop DAWs to $200,000 ultra audio workstations that record, import, edit, perform effects, mix, reformat, export and master multiple digital audio tracks from one common interface, it's a DAW. There is a wide range of overlapping applications at each end of the DAW spectrum so, in no particular priority, we'll focus largely on computer-based DAW tools, interfaces and feature sets used in most television post studios and audio applications today.

**CPU/media:** True to form, computer hardware and software power has increased dramatically the past 18 months. Stand-alone hardware DAWs use the added firepower by providing more tracks and edit features, more slots for hi-res onboard effects processors and memory cards, extra drive bays, and lots of audio, sync and video I/O options. Computer-based DAWs can now tap into dual-processor G4s and P4s and enough dedicated DSP to turn your $1200 desktop into the central hub of a potent record, edit, mix and mastering tower.




Most DAW platforms, like the AudioFile SC from AMS Neve, provide a mature feature set that is well matched to the basic tasks of audio production. Well-appointed plug-in packages can enhance your suite of services. Photo courtesy AMS Neve.

**Plug-in/effects-card support:** Almost every compact hardware DAW comes with a dedicated effects engine and the ability to add two, three or even four more discrete multichannel processors. A seemingly endless stream of software effects plug-ins support computer DAWs. The availability of desired effects should be one of your first considerations when deciding which platform/program to buy.

Look first at the audio services you want to provide in a year or two, and then shop for the best plug-in suite for the job before choosing the platform and DAW software itself. Full automation of every plug-in parameter and ways to edit those moves, multiple open plug-in windows, support for multiple plug-in formats and built-in dynamics processors per channel are other effects goodies to look for in a well-equipped DAW.

**Audio I/O:** Planning your current and future analog and digital I/O needs can be a difficult proposition. Will eight channels of Lightpipe and/or TDIF digital I/O be enough for the projects you'd like to take on in two years? How about stereo S/PDIF or 48 channels of AES/EBU? And can you ever have enough analog XLR and 1/4-inch jacks, be it in an analog or digital studio? If you answered "no" to all the above, choose a DAW with the most scalable analog and digital audio I/O options possible. Other than that, be realistic about your future needs.

**Audio resolution:** 24-bit/96kHz audio is standard equipment on most DAWs today and several offer up to 192kHz support, but make sure your facility

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needs all that resolution. High-quality special broadcast or HDTV work requires the best possible, but even a sub-$1000 computer DAW these days can do the trick if your resolution ceiling doesn't need to go quite that high. Many DAWs also boast 32- and 48-bit internal processing if the sky is the limit for your audio productions.

Edit features: Does a particular DAW support every edit decision list (EDL) format or let you specify handle lengths and set minimum gaps when loading EDLs from rushes tapes? Can you perform both destructive and non-destructive edits to waveforms and track displays in real time without stopping playback? Other sound-for-picture edit features to look for include machine control facilities, easy-to-use ADR and Foley tools, and some form of auto-conform edit tools for working with EDLs. The ability to automatically capture and spot audio elements to picture is important, as is the ability to automatically load and conform any and all EDL files encountered and import an EDL or portion of an EDL into an already event-listed project. Also important is a DAW's ability to simultaneously scrub fully locked audio and video tracks with ease. Full dynamic automation of all faders, mutes, pans, EQ settings, auxiliary sends and bus assignments, and the ability to edit those moves is essential to any fast-paced television edit room.

Ensure that both a DAW's built-in surround interface and that of the third-party surround plug-ins that augment it provide everything you'll need. Look for ways to at least encode Dolby Digital (AC-3) audio mixes and check out what kind of hardware controllers your DAW supports because you'll likely want to eventually migrate from the mouse to a joystick-based, hardware surround mixing solution.

Format and sync support: If seeing OMF, MADI, ADAT, DEVA, LTC and VITC all in the same sentence gets you excited, maybe you've been in the studio too long. There's a dizzying array of proprietary digital audio and video file formats to import, export and generally interact with depending on your facility's client list and delivery needs, but any television-centric DAW should at least be able to support WAV (PC) and/or AIFF and Sound Designer II and Pro Tools (Mac), Avid OMF, and OpenTL for Tascam MM-series dubbers.

Check to see if a DAW can read and generate SMPTE, LTC, VITC, MIDI, PQ burst and Word clock; synchronize with external units via RS-422/Sony nine-pin machine control, PAL/SECAM, NTSC video and Word clock; and lock to LTC, VITC and Biphase at any speed. Another nice DAW sync feature is the ability to remotely control any number of video decks supporting nine-pin or VLAN protocols with the DAW software, and look for current or future plans for a DAW to offer both AES/EBU and MADI card support. ■

*Randy Alberts is a San Francisco-based writer, engineer and producer exploring music and recording technology. He is a regular contributor to* BE*'s sister magazines* Mix, Remix *and* Electronic Musician *and has just published a book about the history of TASCAM for Hal Leonard Publishing.*

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# Measuring 8VSB transmitter performance

BY MIKE WAIDSON

DTV transmission either produces a near-perfect reproduction of the original picture and sound or no picture at all if the signal is compromised in any way. Fringe-area viewers who have tolerated poor analog picture quality over the years may find they cannot receive digital signals. Therefore, it is critical to characterize and monitor the performance of DTV transmitters, because any degradation in performance can significantly reduce the coverage area. To accomplish this, digital television broadcasters and content providers need to ensure signal integrity, coverage and compliance in the RF layer.

In December 1997, the FCC formalized the use of the ATSC standard A/53 for broadcast transmission in the U.S. Within this standard, 8VSB is defined as the terrestrial transmission format. 8VSB is a vestigial sideband digital modular system that uses eight discrete amplitude modulation levels. These eight modulation levels are assigned eight different binary numbers or symbol values to convey the MPEG-compressed transport stream. The MPEG-2 transport stream provides a methodology for the packetization of compressed video, audio and data packets.

The 8VSB transmission system supports a payload data rate of 19.28Mb/s in a 6MHz channel. The input to the transmission subsystem from the transport subsystem is a 19.39Mb/s serial data stream comprised of 188-byte, MPEG-2-compatible data packets. This 188-byte packet has an initial sync byte (47hex) followed by 187 bytes of payload data.

In an 8VSB transmitter, an MPEG-2 transport stream conforming to the SMPTE 310 standard is applied to a synchronizer, which locks to the data rate of the transport stream using the sync byte to identify the start of each 188-byte transport stream packet. The MPEG-2 sync byte is then removed, producing 187-byte payload data packets. The sync byte will be replaced by the segment sync after the forward error correction.

Digital modulation requires new techniques and different methods of measuring the performance of the system. The measurements can be divided into two broad categories: RF measurements made by analyzing the RF spectrum, and symbol data measurements made by demodulation of the 8VSB signal. RF measurements include channel spectrum peak-to-average power and out-of-channel emissions. These measurements can be made with a general-purpose spectrum analyzer with suitable performance, or with an instrument that provides both spectrum and demodulation measurements. Symbol data measurements include constellation analysis, signal to noise, error vector magnitude modulation error ratio, frequency and group delay response error, phase error, and phase noise.

A transmitter should spend a certain percentage of its time at various power levels ranging from its average to its peak. The peak-to-average power is the ratio of the peak transient power to the average envelope power. The peak transient power is the maximum value of envelope power occasionally reached by the digitally modulated signal. This is plotted as a statistical distribution of carrier power over time using a Cumulative Distribution Function (CDF).

The percentage of the time the signal is greater than the average amplitude in dB is plotted and compared with the ideal. A properly operating transmitter will track the ideal curve. Using power amplifiers beyond their capability can cause compression of peaks. This distorts the signal, causing out-of-channel emissions and lower signal-to-noise ratio (S/N). Compression can cause the actual curve to fall below the ideal curve.

The FCC mandates out-of-channel emissions testing to verify that there is no leakage into adjacent channels and other over-the-air services. The power level of emissions on frequencies outside the authorized channel of operation must be attenuated by –47dB at 500kHz from the channel edge. The specification uses a 500kHz bandwidth; but for measurement purposes, 30kHz bandwidth is used and appropriate correction factors are applied to produce a more accurate measurement.

System noise limitations in present-day RF measurement instruments limit direct measurements to –110dB level. Therefore, estimation techniques must be used to make these measurements. One method is to use the transmitter's own bandpass filter, as shown in Figure 1. Normal measurements of signal quality and close-in emissions performance are made with a sample of the signal taken at test point B. To check the transmitter's extreme out-of-channel emissions amplitude, the measurement equipment is connected ahead of the channel filter at test point A. Here the out-of-channel emissions have a much higher amplitude because they have not yet been attenuated by the filter.

After the measurement, the loss of the filter is added to determine the final result. This approach has the advantage of using a filter that is already within the system. However, it requires the characteristics of the transmitter's filter to be known.

An equivalence mask can then be calculated from the data taken at test point A and the channel filter response that is superimposed on the FCC mask. The bandpass filter has a small amount of loss. The loss increases as one moves away from the center frequency in noise power.

8VSB measurements should be performed during commissioning of an 8VSB system and at regular intervals over the life of the transmitter. ■

*Mike Waidson is an applications engineer for Tektronix, Inc.*


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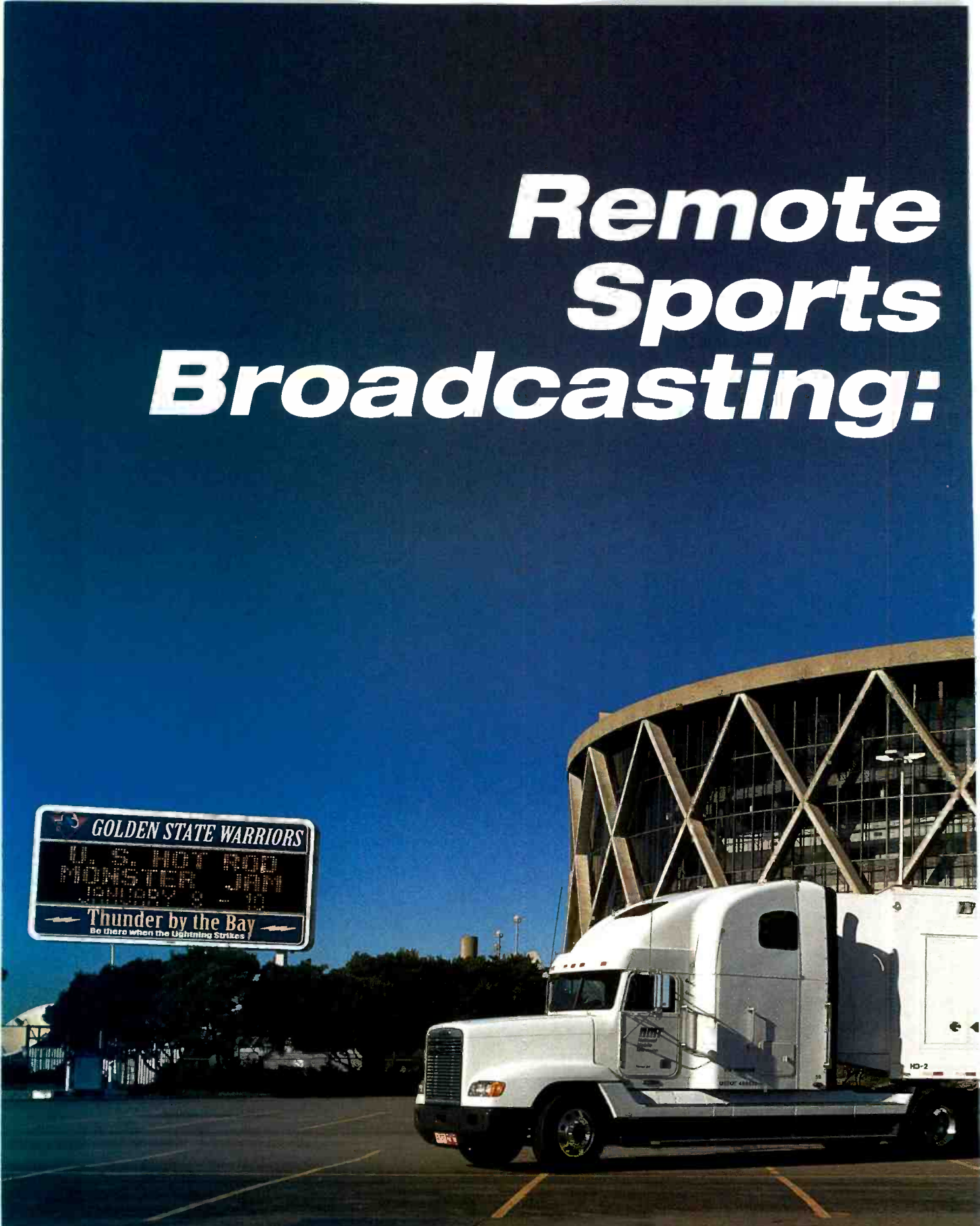



When each production and each user demands different things of a mobile production facility, flexibility is the key to success. The HD-2 live production truck is one of a fleet of 46 fielded by National Mobile Television (NMT). Photos courtesy Concept: Benson & Rice.

# Flexibility on the Fly

By Chris Brown

National Mobile Television (NMT) maintains a fleet of 46 production units that cover a multitude of events, from local concerts-in-the-park, to national awards shows, to its biggest thrust: live sports. It is generally through sports that broadcasters push the technological envelope, simply because of their desire to bring the action straight to the viewer's living room while keeping it both informative and entertaining to watch. Each network has its own spin on what the viewer wants to see, and how they want them to see it. The challenge lies in catering to the different networks so they can give their particular viewership what it wants. Beyond that, mobile broadcast companies must accomplish this using production facilities that are flexible and powerful enough to help each network

achieve their individual production goals.

In any given week, there are some NMT truck units that will see three different shows in three different cities with three different clients — all with differing and individualized production aesthetics that must be accommodated. There also are those clients like CBS Sports, ABC Sports and MSG in New York who have specific units dedicated for their primary use. These units have been tweaked, tuned and customized to meet the technical and production requirements of these specific clients. However, during down time, those same trucks must be intuitive enough for clients to produce a technically solid show without missing a beat.

NMT offers aggressive training on unfamiliar equipment, so operators will feel comfortable in a live production environment, even if it is a few months between training and initial use of the equipment.

## Production

NMT employs a variety of equipment within its fleet of trucks, primarily placed for the needs of the client and the typical event that a specific truck is assigned to. For example, like most technology in NMT's production trucks, NMT's production switcher choices are heavily client-driven.

Oftentimes, despite extensive research in determining a powerful, yet cost-effective production switcher, the client still becomes the ultimate decision- maker. In the case of high-end digital units, NMT carries a variety of switchers including the Sony DVS-7000, Grass Valley 3000, 4000 and, most recently purchased, two Grass Valley Kalypso production switchers. In addition, this spring, NMT debuted the Thomson Multimedia Philips Diamond Digital 35 (DD35) production switcher in three of its trucks.

The choice comes down to the user's comfort level with the switcher provided. In many cases, even with aggressive training for the DD35, once an operator has been trained, it may be several months before they see this switcher in a live production environment.

## Audio

Many of NMT's high-end mobile units carry an SSL audio console, while others employ consoles from Euphonix, Calrec and Midas. In choosing these consoles, the one constant is maximizing the number of inputs available and the board's output flexibility — the audio console's ability to perform internal routing functions and create a variety of sub-mix groupings.

In most cases, when recording ISO feeds for playback, especially with hand-held cameras covering field-level action up close, not only is ambient sound desirable, but the sound from the camera's individual microphone with no announcer. The audio engineer needs to be able to create each of these individual groups and provide them separately for each tape machine, as well as create specialized mixes for talent IFB, and provide a host of different mixes for international feeds as well. Often, clients request more than one mix to go out on their main feed as well.

In keeping up with the latest trends in audio, Dolby Surround is the "not-so" new kid on the block these days. Most of the mobile units have been working with Dolby Surround encoders and decoders to meet the requirements of major network clients. Also, DBX compressor/limiters are one of the basic tools required to easily handle the work of rapidly changing audio levels associated with most sporting events.

> Trucks must be intuitive enough for clients to produce a solid show without missing a beat.

## Recording

NMT employs a wide variety of Sony tape machines, from BVW series machines to HD tape machines, and even some one-inch machines. Again, like everything else, flexibility is the key. In many cases, NMT's analog units not only must carry BVW machines, but also must provide at least one Digital Betacam unit. In all cases, NMT's digital trucks must have analog playback capabilities. Many of our clients carry Beta

SP material from their archives and need the ability to utilize this material in their productions. Likewise, some of the digital trucks also carry analog or BVW series tape machines on their units, as oftentimes clients want the quality, creativity and flexibility that the digital units provide, but still want the ability to walk away with an analog copy.

## Servers

Server technology is still evolving and has not yet reached a point of any standardization. For the moment, NMT utilizes simple server technology by way of the Tektronix Profile and the EVS DDR. Clients want to walk away with finished products in their hands. Currently, that technology, while available in servers, has not been made practical, nor have there been any standards set for it with respect to field production.

In preparation for the eventual technology change, in constructing its latest digital truck, the DX-11, NMT relocated the tape machines above the operator's seated position. This accomplishes two things: First, operator comfort, as the monitors are now at eye-level while seated; and second, when the switch is made to server technology for all replays, the servers will be located up and out of the way of the operator, as the servers will be set-and-forget technology.

## Routing

There is no single solution to serving so many different masters. Today's mobile units are more than just monitors, cameras, tape machines and an audio console stuffed in a 40-foot-plus trailer. These units are filled with the latest technology — technology that at one time you could only find in studios. Clients know this and have extremely high expectations and demands as a result. For the provider, technological flexibility is the first step.

A routing system such as the Thomson Multimedia Philips Venus enables engineers to give each user their own dedicated panel with their own input choices. The Graphics AD is not going to want the same router choices as the Tape AD, and so on. In particular, aboard NMT's DX-6 truck, the ability to take as many as 96 digital sources, 160 analog sources and 128 stereo/audio sources and distribute them individually to each panel is not only what the clients want, but also what they expect.

The only thing you can count on during the setup of a sports remote is that there will be changes. The client expects us to make these changes quickly and efficiently. Shutting down the entire router system to make a change for one person cuts down on the client's productivity. A routing system should allow engineers to make changes to the system on the fly and without hindering the workflow.

> In a world where everyone wants everything digital, the truth is, analog is still the king.

## Communications

In today's sports production environment, there is more coordination between stadium facilities, network feed sharing and statistic feeds than ever before, not to mention the shows themselves have a much higher degree of graphic information than in years past. The more sophisticated the level of involvement by multiple parties, the more important the communication system. Each operator needs to be able to hear and talk to certain people, and you need to be able to make that possible.

At this year's Masters Golf tournament in Augusta, GA, NMT provided a total of three main mobile units and three graphics, audio and fiber optic support units. Five of these units' intercom systems were tied together with all controls and changes being made from a single


**Today's productions require a maximum of visual and aural effects to make an impact on viewers. Unfortunately, space in digital trucks is already at a premium. The answer is robust, flexible gear chosen with a clearly defined goal.**

computer station in one of the mobile units. A day and a half after the Masters, two of the primary units left to do other shows, and the primary golf units went straight into their next tournament. The RTS/Telex ADAM Matrix NMT used offered the flexibility to merge intercom systems for the larger productions, yet easily scale them down to single systems to accommodate other shows.

While intercoms allow the crew to talk back and forth to each other during a broadcast, there is another, sometimes forgotten means of communication that is equally indispensable: the telephone system. The telephone provides the one conduit from the remote site back to the network's master control. For the CBS Sports golf tour, NMT provides three mobile units and CBS provides an office trailer. Each trailer has different router and communications requirements, and within those, each area needs individual telephone lines. The AT&T Merlin phone system installed on the truck allows the engineers to distribute phone sets wherever CBS Sports needs them, and in most cases, utilize preassigned extensions to each area.

## Redundancy

In each case — be it the router, telephone, intercom or any other system — the flexibility is only as good as the engineer's ability to make use of the equipment. This requirement also is true for many of the other systems found on mobile units.

Each of NMT's mobile units has at least two computers — a primary and a backup — running the numerous on-air production and communication systems. Each configuration change is saved so that in the worst case — i.e. losing power — systems can be returned to the state they were in. This fail-safe mechanism minimizes the costly downtime for the client.

Having redundant files also comes in handy when clients like CBS Sports have multiple programs on simultaneously, or when a golf tournament overlaps part of NFL season. The setup time is shortened due to similarities in the programming of the major systems. Once saved, the files can be recalled, keeping the engineer from having to start from scratch each week.

## Integration

A client's preferred outboard gear can pose another significant challenge. To add individual style to a particular sports broadcast, some networks choose to incorporate their own technology. For the on-screen score and stats box, Fox uses the Fox Box, CBS has the Eye Box, and then there's the statistical information coming from Sports Media, plus a host of others, all of which require a completely different set of tools.

It is incumbent upon mobile providers to determine how this technology is supposed to work, and then integrate it into the infrastructure of the unit. In most cases, it's fairly straightforward.

Other existing products such as the DNF controller for the technical director are standard gear. However, some TDs will tweak these devices for their personal use, and NMT has to make sure it still integrates with existing gear when they're finished. In this latter case, CBS Sports has worked with DNF to customize the functionality of the typical control box so that it accomplishes their specific production and technical goals.


**Pay attention to the sight lines of potential operators. While a seemingly small consideration, monitors at eye-level add greatly to operator comfort.**

**With network feeds, instant replay, sideline reports, statistical inserts and pre-produced spots, sports are some of the most complicated field productions, placing a higher demand on effective communications equipment.**

## Infrastructure

In a world where everyone wants everything digital, the truth is, analog is still the king. Despite the complexity of the technology, as a provider of mobile production facilities NMT must face the reality that integrating into transmission facilities, coupled with interfacing with other mobile units and outside devices, requires a large amount of analog capabilities.

In this age of sports broadcasting, many of the robotic and POV cameras provided by various stadiums and arenas have analog outputs. These sources, and many like them, often have to be integrated into a digital environment. In addition, a single game can have as many as three different units covering the same event for three different clients. For this, signals must be distributed in both digital and analog. This means trucks must have a large number of D/A and A/D converters, and 10 or more analog-to-digital frame synchs. While having this analog infrastructure within the digital units is paramount, it also makes building and using them extremely costly.

## When power breaks down

NMT's UPS systems are generally used to back up the truck's main equipment computers and the truck PC. In most cases, trucks carry several computers that drive the routing systems, the intercom and oftentimes the tally system. Additionally, major components of the router system are on the UPS along with the computers. This keeps the "brains" of these systems functional, so there are fewer problems once truck power has been restored.

Because trucks rely on generators and shaky house power (depending on the venue), having these components on an alternate power source can be invaluable, as those oftentimes prove to be the most complex systems to set up for a show. When you couple that with the idea that these systems files are saved to computer disks once truck power has been restored, main components can be back up and running quickly and efficiently. In many cases, these power outages occur during setup, and because time hasn't been lost reprogramming the major systems and bringing these systems back online, negative impact to that given situation is minimized.

> It is through sports that broadcasters push the technological envelope.

## On the road

In the end, technology will remain an ever-evolving fact of life in sports broadcasting. The viewers want more information, better pictures and life-like sound. Choose the technology that will allow you to satisfy the appetites of both users and viewers. It is up to you to figure out how to make your mobile facility work for the client and help where you can.

While client want the latest gear at their disposal, vendors are working feverishly to make it more compact and lighter. Light and compact equipment is a must because trucks have to conform to U.S. Department of Transportation rules and regulations on weight limits, no matter how many innovative new toys clients want thrown on-board.

Remote sports broadcasting is a challenging and demanding environment. While on paper it may look as if the same shows are done week in and week out, from an engineering perspective, it's never the same broadcast. There are challenges every time you show up for a remote.

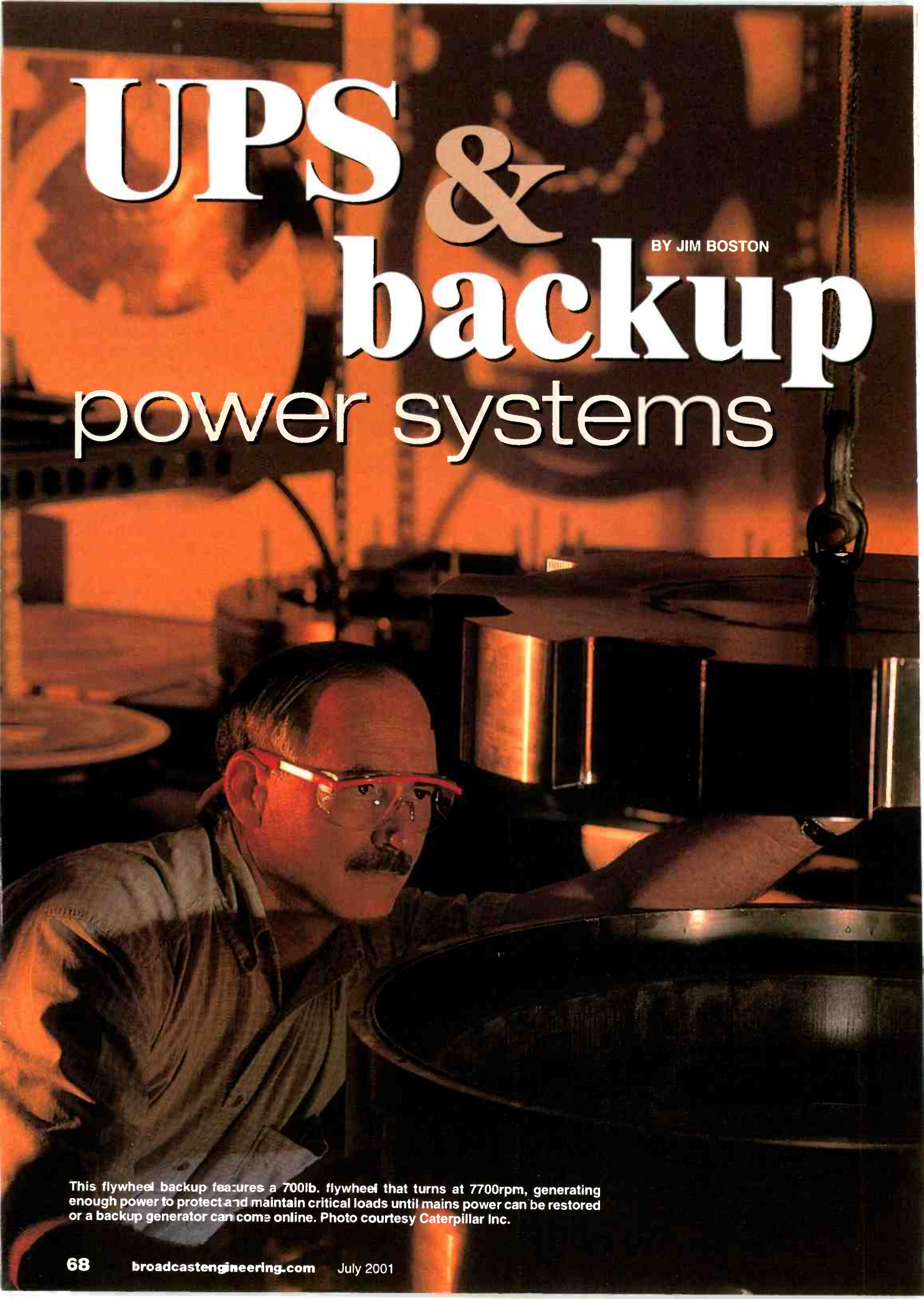
Equipment and technology are your primary tools, and without them we would all just be sitting in a trailer twiddling our thumbs. But when you can take the technology, use it, mold it and apply it to the point where all of the client's needs are met, then you've done your job.

Finally, remote sports broadcasting requires a special combination of tools, talent, cooperation and adrenaline to make it all come together for the viewer at home. Without the dedication of everyone, from the operations and engineering staff, to the maintenance crew, to the administrative team, to the truck drivers themselves, no broadcast could be accomplished. ■

*Chris Brown of National Mobile Television is operations coordinator for CBS Sports Field Operations.*

# UPS & backup power systems

BY JIM BOSTON



This flywheel backup features a 700lb. flywheel that turns at 7700rpm, generating enough power to protect and maintain critical loads until mains power can be restored or a backup generator can come online. Photo courtesy Caterpillar Inc.

Emergency power systems usually consist of two components: a UPS and a generator. The UPS half of the system serves a couple of purposes. Online UPS will filter out power events that happen outside your facility — a necessity, as it is claimed that the average PC is subjected to more than a hundred power events per month. The second function is to provide power if main power ceases. On the average, the time a UPS is expected to do this is under five minutes — enough time to gracefully shut down equipment, and for the backup power generator to ramp up and take over the load.

UPS systems generate emergency power in one of two methods, either via batteries or with a flywheel that acts as a generator. Batteries can supply power for a longer period of time, but with increased cost in size, weight and maintenance. A typical UPS battery cabinet supporting a 100KW for a few minutes can weigh close to 3000lbs.

The flywheel approach uses mains to power a motor, which turns a flywheel. When mains power disappears, the flywheel acts as a generator for a short while due to built-up angular momentum — usually just long enough for the generator to power up and stabilize. A flywheel UPS is generally smaller than the battery versions.

Systems can be set as to how fast they will shed the load back onto the generator once it has come up to speed. If the UPS were to dump the entire load at once, the generator might stall or change frequency so drastically that the UPS would deem the power unstable and take the load back. Once the generator re-stabilized, the cycle could start again. UPS load relinquishing should be set to occur over a 20-second period. UPS systems also will slowly slew to the generator's frequency before shedding the load if that is different than the UPS's own frequency. This is especially important if there are motors as part of the load.

## Generators

UPSs can be big, noisy and can certainly help warm a room, but they pale in these attributes compared to the other half of the emergency power system: the generator. A generator is

three-fourths of a locomotive, using the same diesel motors, but lacking the traction motors to spin the wheels. Generator systems can weigh several tons. They also can have ear-splitting sound levels and parts that approach 2000 degrees. A 2MW generator will weigh more than 30,000 pounds and might need a 2000-gallon tank to fuel a 2900HP engine for a day and a half under full load. It could easily cost $400K.

Many generators have sound-baffling schemes that can lower the noise level, but baffling might affect cost. Whereas a non-sound damped unit might cost $150/KW, sound-damped units can be $225/KW. When turning air to dampen the sound, the unit tends to get bigger and will generally require more hardware. Absorption material also can help to quiet the unit, as does sealing it in a rigid enclosure. Adding a second enclosure around the first (double-walling) takes the level down further.

Like all engineering feats, generators are a series of tradeoffs. They are designed based on the engine driving them. Diesel engines produce more torque at lower RPMs than do gasoline engines. Generators coupled to diesel engines are designed to run at 1800rpm (60Hz AC output), while gas-driven generators run at 3600rpm.

Most modern generator construction consists of two major sub-components — a *rotor* and a *stator*. The rotor's core is a shaft with a number of poles. Each pole is essentially a long piece of iron around which is a coil of wire, forming an electromagnet. Electromagnets can produce more power per pound than permanent magnets. The stator surrounds the rotor assembly and is stationary.

**UPSs can be big, noisy and can certainly help warm a room, but they pale in comparison with the generator.**

Power is generated by a number of inductive steps. At one end of the rotor is a set of permanent magnets. The rotation of the rotor induces a small current into a stationary pilot exciter armature mounted on the stator. The output of this armature is rectified and feeds a stationary exciter-feed coil also mounted on the stator. The exciter-feed coil induces power into the rotating exciter armature on the rotor. This is rectified and fed to the main field coils wrapped around each pole. This forms the electromagnet mentioned before. These rotating poles induce power into three stationary main armatures on the stator, providing three-phase power out. Like everything else, the power out is not equal to the power in. Losses can be categorized: stray losses, friction and windage losses (mechanical), core losses, and $I^2R$ losses (copper losses).

**Large battery banks can serve as effective backup or can be used to assume some of the grid load during peak usage periods, a practice called *peak shaving*. Photo courtesy Caterpillar Inc.**

## Making a choice

There are several choices that will have to be made when selecting a generator. The size of the unit will depend on the use.

Most content providers use generators as standby units. They provide power to a varying load for the duration of the normal source of power. Providers recommend that they be sized initially for 60 percent of the actual load because loads tend to increase over the average 30-year life of the unit.

Television stations seem to forget about studio lights when computing the load. A San Francisco O&O was recently hit with a rolling blackout in the middle of its evening newscast. Everything appeared to be generator-supplied except studio lights. The next segment of the newscast was done with talent holding flashlights under their chins. The effect was interesting, if unflattering, for the people holding the flashlights. Even if you only supply studio work lights under generator operation, the event would go more smoothly than the flashlight approach.

Sizing the generator to match the load is important. If the load is too high, excessive piston loading can occur along with high exhaust temperatures. Conversely, generators that are underloaded can have governor problems (called "engine slobber" by the industry).

A note here about getting the experts involved early: Your generator vendor and contractor should meet to ensure that generator issues are properly addressed. There are often several regulatory agencies that you must deal with when installing a generator. For example, many areas have air-quality control districts. Besides emission requirements they often have restrictions as to how many hours the generator can be run per year; 200 hours is a common limit. Consultation by the knowledgeable parties can keep you from running afoul of local regulations.

**A generator should be sized to 60 percent of actual load, as loads will tend to increase over its lifetime. Proper loading will also increase its lifespan, ensuring a good return on investment.**

## Other considerations

The fire officials should be contacted. In many locales, they issue the fuel permits required to install the needed fuel tanks. Also, most counties or cities have sound restrictions. Where the generator is installed can impact the sound reduction techniques that are required.

> A generator is three-fourths of a locomotive, using the same diesel motors.

If the generator is to be installed inside a building, the building codes in your area will most likely come into the mix.

Keep in mind that standby units must be exercised regularly. Standby engines/generators that cannot be loaded should only be run long enough to achieve normal oil pressure and then shut down (generally under five minutes). The unit must have adequate clean, cool air for cooling and combustion. Exhaust ducting should be thermal wrapped to minimize heat buildup in the room housing the generator. The exhaust stack and muffler must be of sufficient size to keep exhaust back pressure in spec. Excessive back pressure will raise exhaust temperature and reduce engine life.

Vibration is another factor. Many generator vendors have precise specifications as to the concrete pad or base that the generator sits on. Although generators aren't excessively vibration prone, when placed in a larger structure a component of the overall vibration energy could become resonant. While usually not damaging to the generator, it could cause problems in the areas around it. Your vendor and contractor should help determine what isolation is required for your particular installation. In areas where earthquakes are a possibility, special seismic restraining or damping devices must be used. A strong earthquake could impart enough movement into the unit to damage it or have it come off its mounts. Vibration isolators also can reduce noise levels.

A few months ago, most of us thought that an unstable electric power supply was a specter only affecting people who continually worry whether the sky is falling. Considering what we've learned from California — a lesson others across the country might soon share — the worriers were right. Anyone responsible for keeping a television facility on the air should move emergency power to the top of the list of issues. ■

*Jim Boston is director of emerging technology for The Evers Group. David Lingenfelter, director of engineering for The Evers Group, contributed to this article.*

# Which power protection solution is right for you?

**BY ALAN KATZ**

Choosing the right UPS topology for your application will depend on your power requirements (i.e. whether you need to back up an editing deck or a transmitter) and the level of reliability you require (you will not want to spare any margin when backing up equipment critical to the final game of the playoffs). The most common types of UPSs are offline, line interactive and online double conversion.

The most basic (but effective) UPS type is "offline" topology. Under normal conditions, when utility power is satisfactory, the UPS will be offline to let the stable power flow through the UPS to the critical load. If the power voltage drops due to a brownout or blackout condition, the UPS will immediately switch online and begin to produce power from its battery. The transfer time between utility power failure and stable UPS battery power production is typically less than four milliseconds — quick enough to avoid interrupting power to sensitive devices. Better-quality offline UPSs also provide a level of surge protection to prevent power spikes and surges. Typically, offline UPSs will have 10 to 20 minutes of battery backup time at their rated output, with many manufacturers offering additional battery modules for longer run times. An advantage of offline topology is price: a high-quality offline UPS will cost about $150 for a 500VA UPS (perfect for a small workstation) to around $300 for 1200VA UPS (suitable for backing up an editing suite).

If a higher degree of power quality is required (between 500VA and 5kVA), then a line interactive UPS topology is the most appropriate. Similar to offline topology, the line interactive UPS conditions the utility power fed through the UPS output by boosting the voltage if it sags below the nominal level, so as to keep the output voltage stable regardless of the input voltage. Again, line interactive UPSs are traditionally under 5kVA, but a few manufacturers employ that topology for larger UPS systems due to lower manufacturing costs.

For applications requiring the highest level of power quality and reliability, an online, double-conversion UPS topology is the recognized solution. Double-conversion topology is called "online" because the UPS is always online generating 100 percent of the output power from the UPS inverter. When utility power is available, the rectifier on the input of the UPS converts the AC power to DC. The DC power charges the battery while also powering the inverter, which then converts the DC power to pure AC power. If utility power fails and the rectifier stops feeding DC power to the inverter, the inverter is already connected to the battery bank and continues to produce uninterrupted power, without having to transfer modes. Because the inverter generates the output power, it has perfect control over the output power quality, typically maintaining a perfectly stable output voltage with low noise and low distortion. Also, because an online topology isolates the loads from the utility bus at all times, it is the perfect choice for noise-sensitive devices such as audio equipment. Usually online, double-conversion UPSs will cost more than other topologies, but for broadcasting applications, they are well worth the investment.

Operating efficiency is an important consideration with larger three-phase UPSs in the 10kVA to 500kVA range. A typical UPS will only convert 86 to 95 percent (on the high end) of the input power to output power, rejecting the other 5 to 14 percent as heat. Considering that an energy efficiency differential of as little as 2 to 3 percent (i.e. a 92 percent vs. a 94 percent efficient UPS) will result in energy cost savings equal to the cost of the UPS in as little as three to five years at utility rates of $0.10/kWh, UPS operating efficiency makes a tremendous difference to operating costs. Furthermore, the air-conditioning costs resulting from the extra heat rejection of the less efficient UPS can add up to 30 percent to the operating costs alone. In addition, be careful when comparing operating efficiencies, as specification sheets often only quote best-case scenarios. Always ask the manufacturer to provide a test certificate showing the UPS's operating efficiency at your desired load level. Most UPSs operate at well below 100 percent of the rated output and UPS efficiency typically declines at load levels below 50 percent. Demand a factory test certificate at load levels of 25 percent to 50 percent load (where most UPSs operate).

Some transmitters may require special attention when selecting a large three-phase UPS; particularly IOT-based transmitters that employ a crowbar protection circuit (a circuit that prevents damage to the vacuum tubes by immediately shorting the input power to remove current from the tube). During a crowbar trip, the output current can have an instantaneous spike of several thousand amps, followed by a brief surge of two or three times the normal current (double if the tube is cold). When a UPS system exceeds its nominal overload rating — usually around 150 percent — it will immediately switch the inverter off and seamlessly transfer to utility power via a static transfer switch inside the UPS. It will then be up to the utility to maintain the overload current. The problem occurs when the static transfer switch on the UPS cannot sustain an overload condition during a crowbar short circuit, thus risking damage. To ensure the UPS will handle your transmitter load, have the manufacturer demonstrate that the UPS is capable of handling a dead short, (phase to phase) on the output as a condition of purchase.

With the power protection afforded by uninterruptible power supplies, broadcast facilities can operate at all times without fear of costly power problems and downtime. The required level of reliability and power quality requirements will determine which UPS topology is right for you.

*Alan Katz is product manager for MGE UPS Systems, www.mgeups.com.*

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# Harris Cool Fuel solution

BY DAVID GLIDDEN

The majority of DTV channel allocations are in UHF band, and the increased capital cost of UHF transmitters over typical VHF transmitters and increased operating costs for UHF facilities negatively impact TV station strategies in their transition to digital television.

In 1998, the FCC restated the DTV mask requirement, mandating that emissions within the first 500kHz outside the channel edge must be no less than 47dB below the average transmitted power within the channel. The effect of this rulemaking has been to reduce the effective operating efficiency of most digital television transmitters, with consequent increases in capital and operating costs.

To meet these more stringent emission mask requirements, manufacturers have had to derate their prior transmitter output power specifications by 10 percent or more, such that a UHF transmitter previously rated at 25kW might now be rated at 22kW. For some broadcasters, this change has resulted in coverage that is less than desired or, in some cases, the need to purchase additional transmitter amplification equipment to meet the desired TPO.

## Filtering and precorrection

In recent months, Harris Corp., along with key technology partners, has developed a new approach to DTV signal combining and filtering that also provides increased operating efficiency, the Cool Fuel solution. The system consists of a temperature-compensated, sharp-tuned filter with proprietary precorrection and signal equalization techniques in the DTV exciter to provide the potential for increased power output and decreased operating expenses. It also greatly attenuates intermodulation products in adjacent channels, resulting in outstanding compliance with the FCC DTV mask requirement and enhanced interference prevention. The patent-pending filtering technique provides the level of isolation needed for N+1 (upper-adjacent) combining of two channels into a single antenna without serious degradation to the lower analog channel — something that has been virtually impossible until now. In addition, two DTV signals or a lower channel DTV signal and upper channel NTSC signal can be combined with the system.

**The system allows the DTV transmitter to operate in a less-linear area of its amplification curve.**

In 1999, Harris developed the concept of a sharply tuned filter to provide spectral masking of the digital carrier and combining of analog and digital television signals. The sharply tuned filter works as a normal constant-impedance device. (See Figure 1.) When combining is desired, the analog signal is connected to the wideband port on the filter output. The sharp-tuning characteristic allows for the reflection of the analog signal off the output of the filter and into the input of the transmission line.

The filters feature an eight-section bandpass filter to provide the required isolation with temperature stability and low loss. Temperature stability is needed to maintain frequency stability of the transmitted signal into the antenna. Without proper temperature stability, the frequency drift would violate the FCC mask and degrade in-band performance as well.

To achieve effective adjacent channel combining, the sharply tuned filter features an extremely steep, or sharp, attenuation of the adjacent, out-of-band intermodulation products.

Unfortunately, as the digital television signal is shaped through the eight filter sections, group delay increases significantly — reaching as high as 400 nSec at the channel edges. Without proper precorrection, or equalization, this group delay will result in an extremely degraded in-band performance, with the signal-to-noise performance, or error-vector magnitude (EVM), declining to untenable levels. Without proper correction, Harris has measured EVM as high as 18 percent.

Harris has designed and implemented additional precorrection into its digital exciter to properly correct for the increased group delay. With this

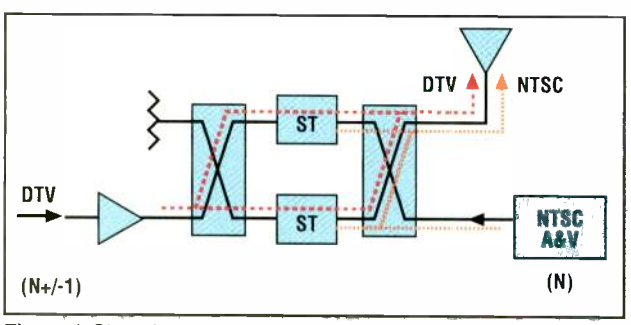


Figure 1. Sharply tuned filter and combining with the Harris Cool Fuel system.


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John Shutt
Staff Engineer
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correction, EVM meets acceptable levels and can be as low as 2.4 percent.

An advantage of the system for N+1 configurations is that the adjacent DTV channel does not significantly impact the NTSC audio signal. When an adjacent NTSC signal is combined with a DTV signal using the sharply tuned filter, the analog channel requires correction equivalent to that used for a simple notch diplexer. This correction capability is already present on most NTSC exciters.

### Enhancing DTV operations

In essence, the system allows the DTV transmitter to operate in a less-linear area of its amplification curve to achieve increased operating efficiencies and increased transmitter power output from a DTV transmitter.

Increased operating efficiencies in IOT transmitters, for example, are achieved by reducing the bias current in the transmitter. The power consumption can be reduced because less bias current is required to generate the same power output from the tube.

Harris has measured savings with the SigmaCD transmitter of up to 100,000kW hours per year per tube, resulting in annual savings per tube of $8000 at eight cents per kilowatt hour. Alternatively, it is possible to achieve greater transmitter power output from the tube by keeping the bias current the same.

Notably, the ability to achieve increased transmitter power output is the greatest for transmitter architectures that have been designed to support either analog or digital transmission. Ultimately, the amount of potential power increase that is possible with the Cool Fuel solution is limited by the amount of headroom designed into the transmitter. Operating power levels are also limited by the ability of the precorrection circuits to minimize the amount of noise within the channel, as well as the ability of the sharply tuned filter to restrict the intermodulation products and ensure mask compliance.

With the Harris Cool Fuel solution, television broadcasters can decrease capital costs through effective adjacent channel combining and enhanced power output. In addition, they can reduce recurring costs through increased operating efficiencies. ■

*For more information on the Harris Cool Fuel solution, circle (451) on Free Info Card.*


*David Glidden is director of television transmission products for the broadcast communications division of Harris Corp.*

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# Sony's Anycast solutions with MXF

BY HUGO GAGGONI

Given the potential impact of the emerging broadband era, Sony is providing customers with IP-ready products and systems including servers, networkable VTRs, data systems, cameras, switchers, monitors, newsroom systems and asset management systems. At NAB this year, Sony demonstrated its new networked nonlinear editing system, the XPRI, along with new switchers and routers that can easily scale between standard-definition (SD) and high-definition (HD) DTV format variations. These Anycast solutions allow broadcasters to benefit from increased revenue opportunities associated with broader distribution channels for their content.

Broadband offers broadcasters and production professionals more speed, flexibility and efficiency in their daily operations, but transferring data between hardware through open systems has become more complex than ever.

File transfer is the routine operation of sending data files between computer and A/V server systems. Today, there are a number of disparate file formats among A/V server vendors, which means compressed video with audio and metadata information often cannot be transferred between different manufacturers. Despite the fact that the server information of different vendors may use the same MPEG encoding parameters and hold the same metadata, the proprietary nature of the file format (the wrapper of such data) usually forces exchanges between manufacturers to occur as an uncompresssed A/V transfer. In this case, most metadata is lost or has to be manually re-entered.

The logic behind this multiplicity of file formats can be understood when examining the design constraints faced by manufacturers of A/V servers. Each file format is designed to satisfy specific hardware/software requirements within the architecture of the individual server system.

It is obvious that the existence of a number of proprietary file formats does not help in installations that require multivendor equipment to work together. Therefore, there is an urgent need for a common file interchange format.

To try to solve this problem, the Pro-MPEG forum began technical discussions in 1999 within its File Interchange Working Group, with the goal of recommending a streaming file format for program interchange between platforms and applications.

**The number of proprietary file formats does not help in installations that require multivendor equipment to work together.**

This Pro-MPEG forum activity attracted a number of A/V server manufacturers with a desire to work toward an advanced single file format. This format has been designated "Material Exchange File" (MXF). The technical document defining the "Template 1" mode of operation of MXF and its usage was completed and submitted to SMPTE in March 2001 for standardization.

The MXF format is designed to support the transport of multimedia information as a file, enabling non-real-time transfers, and to package essence (audio, video and ancillary information) and metadata for effective interchange between servers and between businesses.

The MXF format enables the interchange of finished or almost finished material. It is not intended to be an authoring format. However, careful thought has gone into the design of the MXF specification to ensure that authoring tools such as those established by the Advanced Authoring Format Association are able to open and use MXF files efficiently, without having to make a copy of the file.

The AAF format is a complex file format designed to support full authoring (editing, complex processes, composition effects, etc), with a "structured storage" (a file system within a file) mostly suited for post-production applications. MXF is a subset of AAF in that just enough of the AAF data structure is incorporated in MXF to permit simple file interchanges, efficient storage on a variety of media and transmission over communication links.

By simplifying the authoring file format, MXF enables the exchange of the finished program as a simple transfer and satisfies the need for predictability and latency points in broadcasting applications. At the same time, defining MXF as a subset of AAF allows an AAF system to open an MXF file without modification to either the MXF file or the AAF system.

The MXF format follows a common structure consisting of a file header, a file body and a file footer. The header is small enough for hardware/software parsing and provides information about the file as a whole, including templates for the early determination of decoder characteristics, inclusion of extensive metadata information and hooks for upward compatibility with AAF systems. The bulk of the file is the body, which is a container for the interleaved audio, video and data components and is specifically designed to support file-type as well as streaming applications. The footer provides clear indication that the file has terminated and also includes header information that is created during recording of streams to the MXF file.

One of the main attributes of the MXF format is its streaming characteristic: A

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streaming file format interleaves audio, video, and data essence on a field-by-field or frame-by-frame basis. This interleaving technique ensures that a number of core broadcast requirements are met including recovery from transmission breaks, cuts-only editing and onward transmission (viewing before completion of file exchange).

The coding of information in the MXF format is accomplished using the SMPTE KLV paradigm: Every material component is described by a string of bytes representing a "Key, Length and Value" combination. The key defines or labels the type of information to be coded. The length defines how long the value of the component is. After this, the value of the information follows. The key values of elements that are not understood by the parser/decoder can be skipped, continuing with the examination of the next key.

MXF currently supports the carriage of MPEG-2 4:2:2P@ML within a Content Package (CP) container and DV containers carrying DIF packets as well as uncompressed A/V data. Other essence formats and containers are being discussed and could be included in the future.

To date a number of vendors are developing server systems incorporating the use of MXF. In particular, Sony is updating the file systems in use in its line of professional server products to MXF. In addition, the MPEG-2 4:2:2P@ML bitstreams in use in Sony's studio VTRs can be transported over streaming connections (SDTI-CP) to server products that readily wrap the content packages of the stream connection into MXF files. The link between metadata and essence elements provided by the MXF file system also facilitates the exchange of metadata information captured in the field by MPEG-based cameras.

It is hoped that the progressive adoption of these advanced file formats — AAF and MXF — by manufacturers of professional broadcast products will lead to a more harmonious, less complex and higher-quality exchange of program material among increasingly more sophisticated, multivendor systems. ■

*For more information on Sony's Anycast solutions with MXF, circle (452) on Free Info Card.*

*Hugo P. Gaggioni is vice president of Strategic Technical Development and Marketing for Sony Broadcast & Professional Company.*

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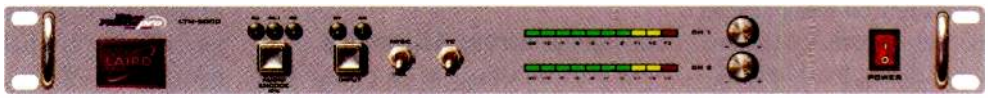

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# Irdeto's conditional access datacasting

BY JOE ZALLER

The U.S. terrestrial broadcast industry is in the midst of a dramatic upheaval that threatens its traditional way of doing business and making money. As a result, over-the-air (OTA) broadcasters are scrambling to find new and sustainable business and revenue models. One promising source of new revenue is datacasting. Datacasting is a supplemental DTV technology that enables the wireless transmission of Internet protocol (IP) encapsulated data to IP-enabled set-top boxes or personal computers.

## The beginning of a new model

Today, the revenue models of most local broadcasters rely on being paid to carry network content to the consumers in their area and selling local advertising. So far, the majority of the proposed datacasting solutions seem to be following this traditional broadcast station business/revenue model. Data broadcasters assume that content owners will pay for their content to be carried to consumers.

However, following this "old paradigm" approach is short-sighted in an environment where the trend is toward local affiliates paying for the privilege of carrying network content, where DTV may mean the end of "must-carry" regulations for cable, and where ad revenues are being eroded by the migration of audiences to cable and satellite services that offer more choice in the form of both premium and specialized niche channels.

Irdeto Access's Irdeto CypherCast, datacasting content production system.

For this reason, a major, and as of yet untapped, revenue opportunity for datacasting is the delivery of premium services to both consumers and business customers. Key to this new approach is the adoption of traditional pay-TV techniques, particularly conditional access and subscriber management.

**Conditional access allows the local TV station to use the same spectrum to deliver different services.**

## Conditional access datacasting

Data broadcasting has the potential to become a major revenue source for OTA broadcasters. What's missing so far is a comprehensive explanation of how conditional access fits into the picture.

Here is an example of how this might work: In the current model, content might originate at a network operations center or content aggregator and be sent by satellite to local affiliate TV stations, who in turn re-broadcast this content to consumers and businesses in their area. This segment consists of data whose carriage to the end-user has been paid by its rights holder and can be accessed for free by any viewer with an appropriate receiving device.

Alongside this "free" component, however, premium datacasting streams would be made available on a conditional access basis to consumer and business subscribers. Paying customers would receive a payload of premium/subscription/private network services, re-encrypted at the local station and accessed by subscribers by inserting a smart card into their set-top box or a PC enabled with an IP tuner.

Conditional access allows the local TV station to use the same spectrum to deliver different, individualized data services to each paying home and business subscriber. Each home or business is granted access to only the data services they have paid for. Sensitive corporate or government data is protected from unauthorized access through the system's encryption technology.

What kind of "data" are these viewers receiving? It could range from stock quotes to movies for home subscribers or traffic updates purchased by a municipality for IP-enabled billboards on the freeway. With currently available conditional access solutions, a local station could broadcast up to 1000 individual multicast streams arrayed in up to 100 distinct program services for as many as 250,000 subscribers in a local viewing area.

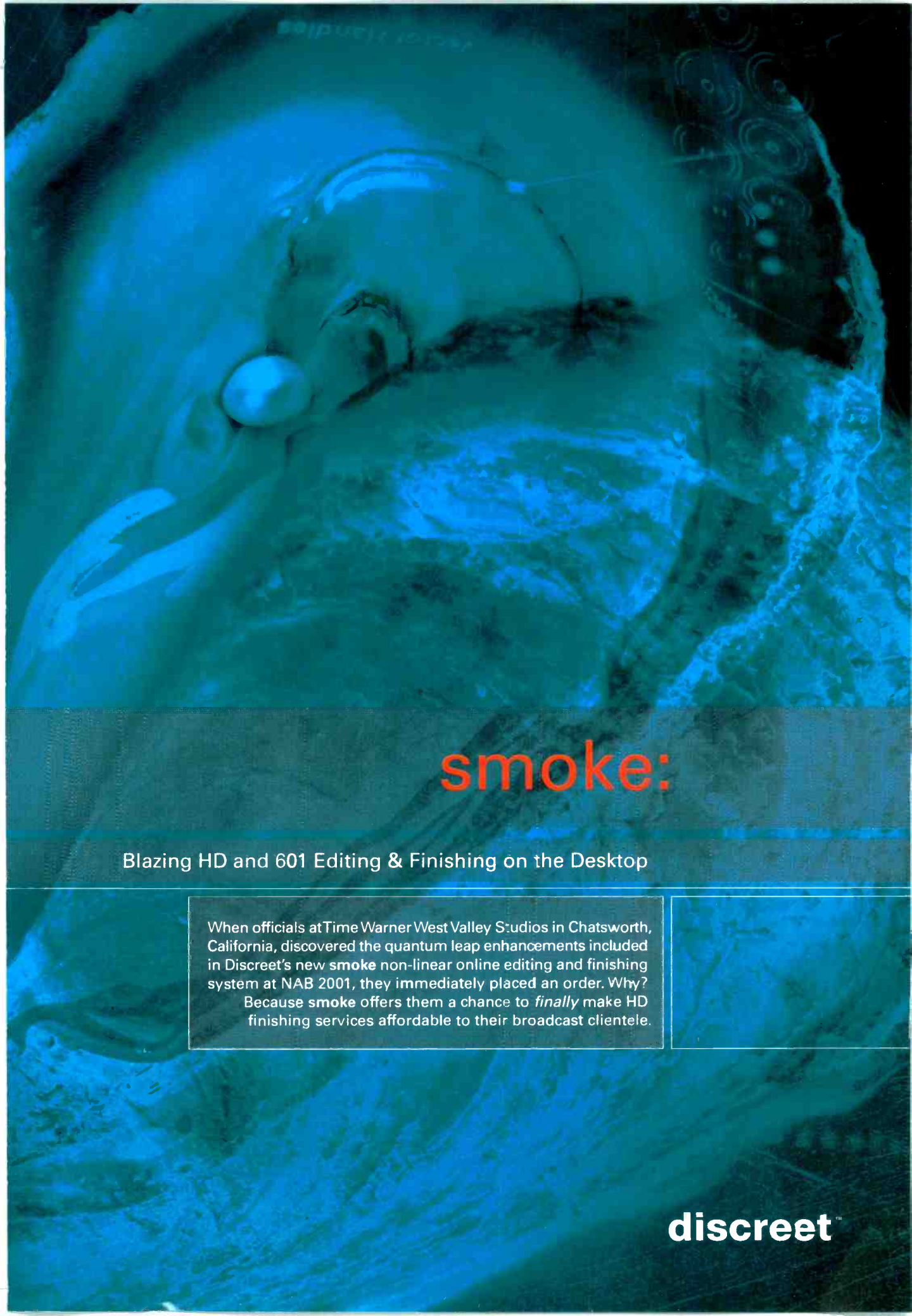
## Seizing the opportunity

Oddly, most current data broadcasting proposals do not explicitly address conditional access, but rather seem to rely on content owners paying for the services in the form of advertising — similar to the current broadcast model.

Although datacasting with conditional access will require a certain learning curve to become a reality, the potential returns are enormous. What's more, the technology exists today in a mature and proven form. For terrestrial broadcasters, it's one of the most promising new ways to increase their audiences, to bring in subscription revenues and even to create an entirely new way of doing business. ■

*For more information on Irdeto's CypherCast, circle (453) on Free Info Card.*

*Joe Zaller is the vice president of marketing for Irdeto Access.*



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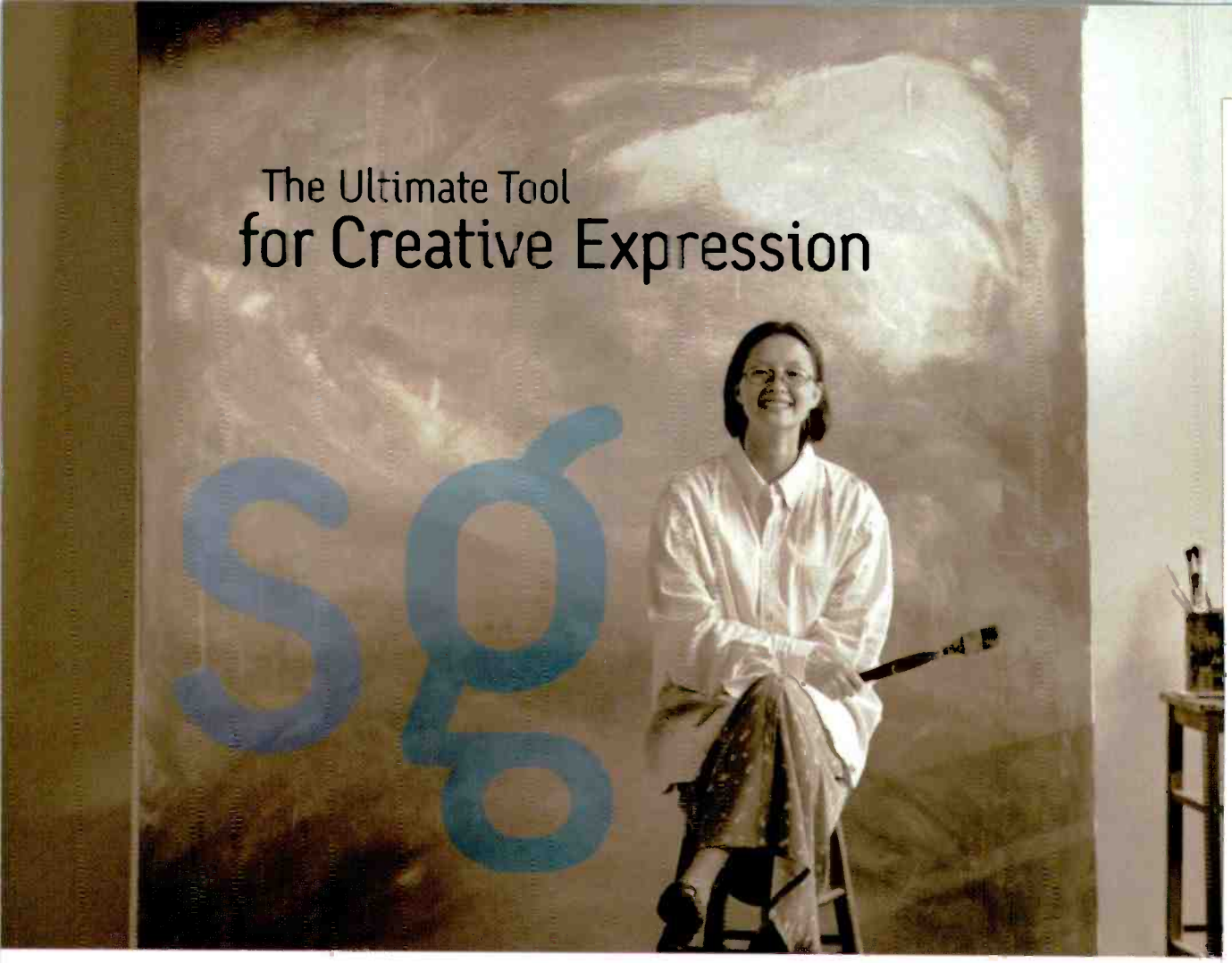

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# Video tape recorders

**BY JOHN LUFF**

Commercial videotape recording began in the late 1950s. Though audio recordings on acetate strips had been done for many years, the considerably higher bandwidth of the television signal required new engineering approaches. The first recorders sold to CBS by Ampex recorded using high-speed rotating heads. Though only monochrome, those first recordings changed forever the way television programs were produced and distributed.

The first recorders consisted of racks of vacuum tubes. The recordings and servos were entirely analog, and the timer was mechanical and accurate to a few seconds an hour on a good day. Editing was done by razor blade, with a microscope used to view the patterns of the tracks on the tape after "developing" the tape.

With the advent of electronic editing scarcely a decade later, VTRs had to be controlled with daunting precision. The erase current had to be turned on at the right moment, without erasing the outgoing scene, and the new recording had to be precisely timed to begin exactly where the erasure had cleaned a spot for it. A reel of tape for an hour weighed 20 pounds and the maximum recording was 90 minutes. Eventually the mechanics and electronics evolved to make the recordings more stable, repeatable and editable.

Over the last half century, the distance between tracks has steadily dropped (the size of the tape is as low as 1/16 of the quad tape of the 1950s), yet the precision of the tracks laid down on tape has improved dramatically. Recorders are essentially all digital, with analog recorders beginning to wane even in consumer products.

Prices have dropped to under $5000 for a simple recorder for professional use. These recorders produce a picture easily the equivalent of the recorders of 30 years ago, when an Ampex AVR-1 cost $120,000. Modern digital video recorders use a variety of picture recording data rates. That range of almost 15:1 yields a wide range of features and capabilities, including recording of multiple channels of audio and metadata. Professional models vary in price from $5000 to over $80,000.

**Videotape still stores the intellectual assets of several generations of television production.**

There are a number of formats in production, but it is a fact that, in the end, the picture quality from any modern professional-grade VTR will be roughly similar for most uses. High-end post production demands high performance, and some applications require specific attributes to support editing and effects work. Features, after market support, price, VTR family support for future interchange, field maintainability, I/O and control options, and other factors will usually be more important than the basic picture quality.

For the last decade or so there has been constant conversation among industry experts about what the role of linear recording will be in the future. Optical disk and hard disk have improved substantially in performance and now can rival the ability of linear videotape to provide the sustained data rates necessary to make video recording practical. Generally it is assumed that a removable medium is required, but with the increase in hard disk capacity, it is not hard to see a post-production recorder for a studio that has a removable drive with perhaps 500GB of random access recording capability. Optical recordings have yet to economically achieve the sustained bandwidth necessary to support high-bandwidth professional recordings. However, with DVD RAM we may well see direct competition to linear tape as a field and studio recording medium in the next few years. Optical disk recordings hold the possibility of long shelf life with little if any deterioration.

Any recitation on the evolution of videotape also must recognize the importance of the introduction of consumer video recording. Before the VHS/Betamax wars a couple of decades ago only professionals could record video. As mass market consumer electronics manufacturing techniques were applied to video recording it became inevitable that companies like Panasonic and Sony would find ways to leverage the research they were doing into inexpensive professional recording as well.

Much of the same recording electronics that show up in the crossover camcorder are inside the "professional" studio VTR for multiples of the same price.

Can alternative mediums replace videotape? At some point in the future, some major breakthrough in the physics of recording may bring about the decline and marginalization of linear tape. However, videotape is still ubiquitous, inexpensive and stores the intellectual assets of several generations of television production. That is hard to replace. ■

*John Luff is vice president of business development for AZCAR.*

# New Products

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**SYPHA Website:** provides free access to nonlinear editing product listings at NLEguide.com; the NLE buyers guide can be found on the website, where searchers can look for a specific product by application, type, host, platform, video I/O, cost range, manufacturer or name; +44 (0) 20 8761 1042; fax: +44 181 244 8758; www.NLEguide.com.

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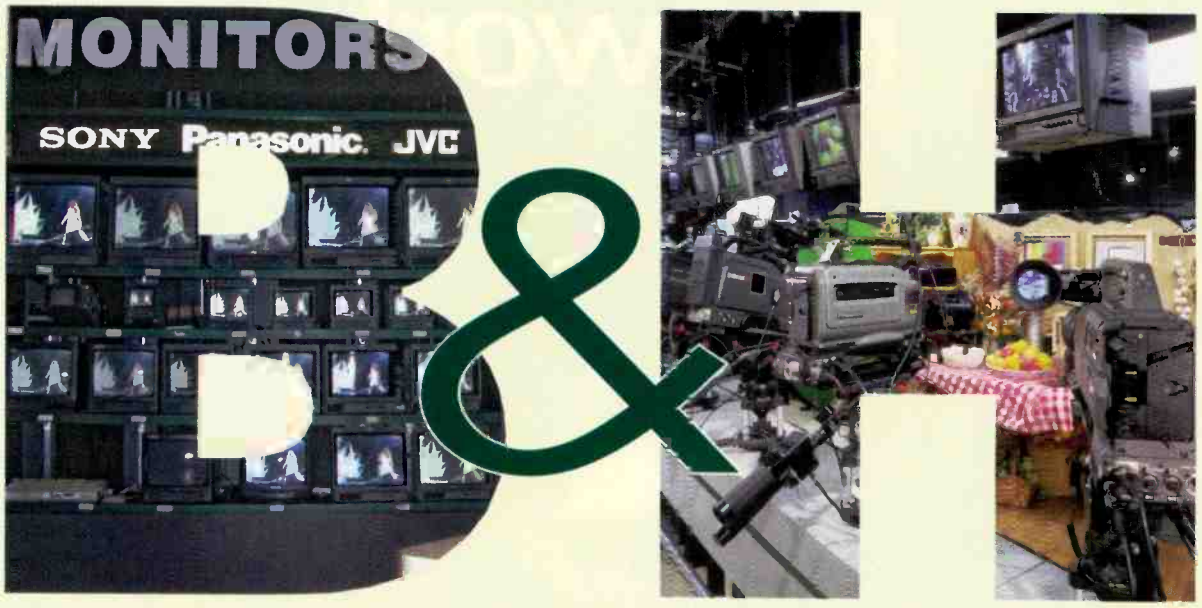



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- **DXF-801 high resolution 1.5" black & white viewfinder** (same as on DSR500/1 & DXC-D35) enables easier focusing. Automatically switches from 4:3 aspect to 16:9
- **58mm lens** with **12x optical zoom**
- **Records in DVCAM or DV**, standard tapes or mini. Up to 270 minute recordeding in DV mode onto a 184 min. DVCAM tape
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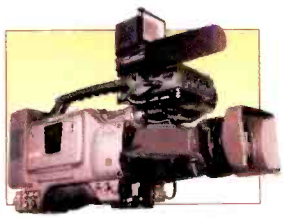

### DSR-300A
#### 3-CCD Digital (DVCAM) Camcorder

The affordable DSR-300A actually extends operational convenience with a range of new features and peripheral products. Remarkably compact and lightweight, the improved DSR-300A provides high mobility without compromising picture quality and can be held comfortably on your shoulder through the longest shoots and gives videographers the ability to acquire their footage quickly and easily.

- The DSR-300A has three 1/2" IT Power HAD CCDs to deliver 800 lines of horizontal resolution, 62dB S/N ratio and high sensitivity of F/11 at 2000 lux.
- With built-in 26-pin VCR interface, they can feed composite or S-Video output signals to an external recorder for parallel or back-up recordings. VCR recording modes including Parallel, Internal (only) and External (only) are selected via the trigger switch positioned on the operational panel.
- LSI Digital Signal Processor (the very same one used by the DXC-D30 cameras) for a high signal-to-noise ratio of 62 dB
- Both mini cassettes (PDVM series) and standard cassettes (PDV series) can be used with the DSR-300A. With PDV-184ME (standard), a maximum recording time of 184 minutes can be achieved. They can also play back tapes recorded in the consumer DV format.
- For operational convenience while shooting, the Time Code is superimposed on the viewfinder screen or MONITOR OUT screen, even during playback.
- DXF-801 viewfinder featuring variable peaking, 3 level tally light and a white LED light with 2 levels of intensity to illuminate the lens setting. • IEEE1394 i.Link (out only)

### DSR-500WSL
#### 2/3" 19:9 CCD (DVCAM) Camcorder

The DSR-500WS camcorder gives the video journalists the ability to acquire footage quickly and easily because the required functionality and performance was packed into this camcorder. In the meantime, the next generation widescreen TV's have been introduced and the demand for video material in widescreen (16:9) has greatly increased not only in broadcasting, but also in the event production and corporate communications market. To meet this demand , Sony offers this Widescreen Digital Camcorder. The DSR-500WS offers outstanding picture quality by adopting full Digital Signal Processing and three 2/3-inch (520k) Power HAD WS (Wide Screen) CCDs which are specifically designed for a 16:9 aspect ratio, switchable to 4:3 full screen. The camcorder extends the mobility, operational convenience and system flexibility with a range of peripheral products. Built-in digital output of the i.LINK interface for backup and simple field editing is just one example. Technological advances in Sony DSP and CCD Technologies, many powerful options and a convenient low price-point make the DSR500WS a formidable tool for a wide range of applications.

### DXC-D35/D35WS
#### Dockable (DVCAM) Camcorder

The DXC-D35/ D35WS cameras are designed to the highest specifications, providing unprecedented video quality in this price range. The DXC-D35 is at home in the studio or field, docking directly to a host of backs including Betacam SP and DVCAM, as well as studio backs and viewfinders. The highly adjustable picture means that these cameras are ideal for capturing detail in low or changing light, as well as compensating for peoples skin flaws while keeping the rest of the image sharp. DXC-D35WS is switchable 4:3 to wide screen 16:9 ratio.

The DXC-D35WS camera is the latest Sony digital camera designed to the highest technological standards. With the proven Sony DSP technology combined with Sony high performance 16:9 CCD's. This high standard was previously held by the DXC-D30 series now being replaced by the NEW DXC-D35 series. DXC-D35 series feature a new Prism Assembly, new Pre Amplifiers, new DSP Software and a new Digital Encoder resulting in astounding performance. The DXC-D35WS camera fully interfaces with Sony's CCU-TX7 Wideband Component Triax System. It provides 8 set-up files (3 user) as a stand alone. 16 additional scene files (all user settable)are available when combined with the RCP-TX7 remote control panel. The DXC-D35WS is equipped with three 2/3" IT Power HAD CCD's switchable between 16:9 and 4:3 aspect ratio's. The camera docks to DSR-1 DVCAM and DNV-5 Betacam SX recorders for digital video recording, or PVV3 and BVV-5 Betacam SP recorders for analog recording.

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- VF lens light with on/off switch • 3 level Tally light
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- Lower minimum illumination (0.25 lux with HyperGain)
- Better color reproduction at high gain
- Improved dark detail and contrast • New preamplifier, prism and encoder • Better performance at overloads
- Reduced noise at Gain Up • Variable color temperature adjust
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- New HyperGain mode of 42dB gain
- Aspect ratio select from Main Menu

## JVC

### GY-DV500U
#### 1/2-inch 3-CCD Professional DV Camcorder

QUICK DIAL 74

The GY-DV500 combines the convenience and cost-effectiveness of Mini DV with the performance and features you need. Incorporate three 1/2-inch 380,000 pixel IT CCDs for superior picture performance (equivalent to 750 lines of resolution) superb sensitivity of F11 at 2000 lux and minimum illumination of 0.75 lux (LoLux mode). Rugged construction with a rigid diecast magnesium housing. Extremely portable, compact and light weight (less than 11 lbs. fully loaded). Additional features like the menu dial and Super Scene Finder assure ease-of-use and shooting flexibility, while the IEEE1394 and RS-232 interface allow integration into various non-linear and post-production systems. A professional camcorder in every sense, the compact, lightweight GY-DV500 redefines acquisition for corporate, educational, cable and broadcast production, as well as wedding videography and multimedia applications.

**Professional Specifications**

- Applies JVC's DSP with advanced 14-bit video processing to bring out more natural details, eliminate spot noise, accurately reproduce and restore color in dark areas.
- CCD Defect Correction function evaluates white defects with the lens closed and then stores their addresses in memory. When the camera is turned on, the data is sent to the DSP for storage and real-time correction.
- Black Stretch/Compress function ensures accurate reproduction of black areas on the screen.
- Multi-stream parallel digital pipeline processing at 40 MHz creates an ultra-smooth gamma curve, calculated using a true log scale algorithm.

**Professional Performance**

- Multi-zone iris weighting system gives priority to objects at the central and lower portions of the picture for accurate auto exposure under any condition, even if a bright subject moves into the picture.
- Adjustable gamma for adjusting the "feel" of the picture according to taste. Adjustable detail frequency for setting picture sharpness for a bolder or finer look.
- Viewfinder status display uses characters and menus to display selected information, including audio indicator, tape and battery remaining time, VCR operation and warning indicators. Camera settings and setup parameters can also be checked at a glance.
- Highlight Chroma Processing maintains color saturation in highlights. The result is natural color reproduction, even in bright highlight portions of the picture.
- Smooth Transition mode ensures no jump in color when manually changing gain or white balance settings.

**Professional Audio**

- To complement its superior video performance, the GY-DV500 offers outstanding digital PCM sound. You can choose between two 16-bit 48-kHz channels or two 12-bit 32-kHz channels with a dynamic range of 85 dB.
- In addition to camera mounted mic, has two XLR-balanced audio inputs with 48v phantom power and manual audio control. Phantom power can be switched off when not in use.
- Side-mounted speaker lets you monitor audio in playback and recording modes without headphones.

### GY-DV550U
#### 1/2" 3-CCD DV Camcorder

Introducing the Versatile GY-DV550 from JVC. Designed by professionals, for professionals, the GY-DV550 is the world's first DV camcorder to offer studio camera capability. Thanks to the built-in 26-pin interface, you can connect the GY-DV550 to a CCU for remote-controlled studio operation or backup recorder in the field. But that's not all: it also comes with pool feed input/output, so you can transfer image data back and forth to another camera or cameras, making it ideal for special shooting situations such as press conferences, exclusive interviews, and sporting events. Record isolated camera views (ISO-Cam) during a live multi-camera shoot, making it ideal for parallel shooting at live concerts and other events. Naturally, we've made sure the GY-DV550 is equipped with all the other capabilities you need, including a standard 1/2-inch bayonet mount for use with a great diversity of professional lenses, bidirectional IEEE 1394 (NTSC), two 48 kHz 16-bit digital PCM audio channels, and a built-in SMPTE or EBU timecode reader/generator, as well as XLR microphone inputs, audio outputs, headphones output, and both composite and Y/C outputs. Maximum versatility, top-level performance, and superior cost-efficiency make the GY-DV550 the smart solution for producers who need a camcorder capable of doing double-duty in both the studio and the field.

**Ready for EFP remote control** (RM-LP57/LP55) The EFP remote connects directly to the GY-DV550 for precise control over the video parameters.

**Return video output for Tele-Prompter** Tele-Prompter capability assures full support for studio program production.

**Genlocking function** To meet the demand for systemization, the GY-DV550 is equipped with a genlocking function that includes SC lock to assure high-resolution pictures.

**State-of-the-art 1/2" 3-CCD image pickup** Incorporates three 1/2" 380,000 (NTSC)/440,000 (PAL) pixel interline-transfer CCD's. Each CCD is equipped with highly advanced circuitry that eliminates vertical smear when shooting bright lights in a dark room. Lag and image burn are also reduced to indiscernible levels, while high sensitivity of F11 at 2000 lux assures creative flexibility and simplifies lighting requirements.

## Panasonic

### AJ-D610WA
#### 2/3" 16:9 IT-3CCD DVCPRO Camcorder

The AJ-D610WA is an affordable DVCPRO camcorder which combines three high sensitivity 2/3" IT CCD's with digital component technology, to create a true broadcast recording. The AJ-D610WA is switchable between 16:9 and 4:3 aspect ratios. A built-in PCMCIA card slot makes it quick and easy to adapt the camera to different shooting conditions. Features Super Gain, Super Iris, and Digital Signal Processing (DSP). The AJ-D610WA can operate with a minimum illumination of 0.5 lux (F1.4, +36 dB Gain), and resolves 750 lines of resolution.

- The AJ-D610WA has three high density (520,000 pixels) 2/3" CCD's. The CCD's feature a large light collecting area that gives the camera a S/N ratio of 63 dB, plus a sensitivity of f 11.0 @ 2000 lux.
- The Digital Signal Processing (DSP) helps to deliver a very high quality picture. The user has the ability to adjust different parameters of the camera to accomodate any situation.
- A PCMCIA card slot is built into the operator side of the camera, allowing the set-up (DSP) data to be saved. The saved set-up data can be used to reset the camera parameters.
- The optional AJ-YAP900P Picture Link Board is part of an exclusive Panasonic production data information system which stores shot logging in camera memory and records it on tape during the eject cycle. The logging information can be read by Panasonic's newsBYTE DVCPRO native nonlinear news editing system.
- Exceptional resolution of 750 horizontal lines.
- A Super Gain feature is available to boost gain by a full +30 dB or +36 dB for high quality shooting in low light, making it possible to shoot as low as 0.5 lux (f1.4, +36 dB).
- An optional Digital Triax for studio or mobile use is available. • A six speed electronic shutter (1/100 to 1/2000 sec) features Synchro Scan to match the frequency of a comuter monitor.

# SONY

QUICK DIAL 72

## DSR-1500
### DVCAM Studio Editing Recorder

DVCAM becomes more and more flexible with the introduction of this brand new, half-rack width studio editing deck. The DSR-1500 boasts studio editing function capability in a compact size. The new DSR-1500 incorporates the same innovative, high standard technology featured in the DSR-2000.
The space-saving size makes the DSR-1500 ideal for installations in OB vehicles and desktop editing systems.

- SDI interface ensures a migration path to Digital Betacam™, Betacam SX™ and SDI-based systems.
- SDTI(QSDI) and i.LINK IEEE-1394 interfaces enable a high quality, virtually lossless transfer with DV compression based systems.
- Compatibility to consumer DV (SP mode only) and DVCPRO 25 format recordings in addition to DVCAM, automatically accommodate all cassette sizes without the need for an adapter.
- Analog input interface board which includes component, composite and S-Video is also available as an option.

## DSR-1600/1800
### DVCAM Studio Editing Player/ Player Recorder

The DSR-1600 is a **studio editing player**, and the DSR-1800 is a **studio editing recorder**.
Both incorporate innovative technology at an affordable price. Excellent playback of all DV based (25 Mbps) formats and cassette sizes is possible without the need of an adaptor. A jog/search dial is standard, including jog audio. A variety of option boards are available for SDI, SDTI, and i.Link outputs.
They both provide two selectable audio channel modes: Two channels of 16-bit (48 kHz) Four channels of 12-bit (32 kHz), PCM Digital Stereo recording is used in both modes to ensure superb audio performance with a wide dynamic range and excellent signal-to-noise ratio.
• Automatically adjust for playback of any DV based format, including DV (SP only), DVCAM or DVCPRD 25.

## DSR-2000
### DVCAM Editing Recorder

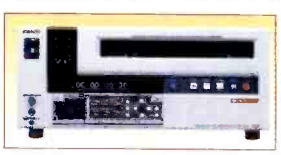
The DSR-2000 is a highly flexible DVCAM studio deck designed for demanding ENG editing. It can playback all DV (25 Mbps) based formats, including two consumer DV formats (Standard and Long Play), as well as all types of DVCPRO tape as an editing source, without any mechanical tape adapters. Equipped with audio/video pre-read editing and includes a Jog/Shuttle dial that allows two-machine editing. A SMPTE standard MPEG SDTI-CP interface option is available for the DSR-2000 to output an MPEG stream in addition to the optional i.LINK interface. This allows the DSR-2000 to seamlessly link to Betacam SX and other MPEG-based video equipment by means of SDI, i.LINK and MPEG SDTI-CP.

## DSR-11
### Compact DVCAM VTR

Compact desktop DVCAM recorder. This VTR provides a powerful and cost-effective option for NLE editing systems. Provides basic VTR features, along with an i.LINK (IEEE1394) interface and is compatible with both NTSC and PAL color systems. Designed to be used in either a horizontal or vertical position; A footprint of only 2 3/4" in the vertical position.

- The DVCAM format uses 8-bit component digital recording at 25 Mbps, with Intra-frame 5:1 compression, 500 lines of resolution and 4:1:1 color sampling. A 15 micron track pitch provides superior picture quality, superb multi-generation capability and production flexibility. Two 1/4" ME cassette sizes are available: Standard and Mini.
- Plays and records either a DVCAM format signal or a DV format signal. • Both Mini and Standard size cassettes can be used with the DSR-11 without the need of an adaptor.
- Play or record in either the NTSC or PAL color systems.
- Equipped with a 4-pin i.LINK (IEEE-1394) interface, for lossless transfer of digital video and audio information with other IEEE-1394 equipped devices. The single 4-pin i.LINK cable can be connected to MAC or PC based NLE systems or to another VTR for degradation-free editing.
- DV EE (electronics to electronics) Out: Analog input signals can be converted into digital signals, and can be simultaneously output from the i.LINK interface.

## 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.
- Auto repeat of entire or a specific portion of the tape.
- Built-in character generator can display VTR status, time code, self-diagnostic messages, set-up menu, etc.
- Both read LTC Time Code) and UB (User Bits). The UVW-1400A also generates LTC and UB ( Free-Run/Rec-Run).
- 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.

## 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.
- Two types of component output: via three BNC connectors or a Betacam 12-pin dub connector.
- RS-422 interface for editing system expansion.
- Frame accurate editing is assured, thanks to sophisticated servo control and built-in time code operation.

## 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 & 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

## PFM-42B1
### Flat Panel Plasma Display Monitor

Flat Panel AC plasma display monitors are used where space and aesthetics are a major consideration. They accept and automatically detect computer and video signals ranging from NTSC to HDTV and VGA to UXGA.

- 42-inch screen
- 1024 x 1024 pixel display, with a 160° viewing angle
- Aspect ratios from standard 4:3 to widescreen 16:9
- Accommodate DVD presentations and widescreen broadcasts
- Advanced scan converter reproduces digital video signals (including SDTV, and HDTV) & UXGA computer signals
- 3.25" thick & weighs 65.5 lbs.


## PROFESSIONAL VIDEO TAPES

QUICK DIAL 71

### FUJI

**Professional Grade VHS**

| | | | | | |
|---|---|---|---|---|---|
| PG-30 | 2.29 | PG-60 | 2.39 | PG-120 | 2.59 |

**Broadcast Grade VHS Box**

| | | | | | |
|---|---|---|---|---|---|
| BGR-30 | 3.49 | BGR-60 | 3.99 | BGR-120 | 4.69 |

**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 | 4.49 | | E630HME | | 7.69 |
| P660HMP | 6.29 | | E660HME | | 10.49 |
| P6120HMP | 8.49 | | E6120HME | | 13.99 |

**M321SP Metal Betacam (Box)**

| | | | | | |
|---|---|---|---|---|---|
| 05S | 10.99 | 10S | 11.99 | 20S | 12.99 |
| 30S | 13.99 | 60L | 20.99 | 90L | 32.99 |

**DP121 DVC PRO**

| | | | | | |
|---|---|---|---|---|---|
| 12M (Med.) | 7.49 | 23M | 8.79 | 33M | 10.99 |
| 63M | 19.99 | 66L | 22.50 | | |
| 94L | 30.99 | 126L | 39.99 | | |

### maxell

**Broadcast Quality Hi8 Metal Particle**

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

**P/I PLUS VHS**

| | | | | | |
|---|---|---|---|---|---|
| T-30 Plus | 1.69 | T-60 Plus | 1.99 | T-90 Plus | 2.09 |
| T-120 Plus | 2.19 | T-160 Plus | 2.69 | | |

**HGX-PLUS VHS (Box)**

| | | | |
|---|---|---|---|
| HGXT-60 Plus | 2.69 | HGXT-120 Plus | 2.99 |
| HGXT-160 Plus | 3.99 | | |

**BQ Broadcast Quality VHS (Box)**

| | | | | | |
|---|---|---|---|---|---|
| T-30 BQ | 3.89 | T-60 BQ | 3.99 | T-120 BQ | 5.99 |

**BQ Professional S-VHS (In Box)**

| | | | |
|---|---|---|---|
| ST-31 BQ | 6.79 | ST-62 BQ | 6.99 |
| ST-126 BQ | 7.45 | ST-182 BQ | 13.99 |

**Betacam SP**

| | | | | | |
|---|---|---|---|---|---|
| B30MSP | 13.49 | B60MLSP | 19.99 | B90MLSP | 27.95 |

### Panasonic

**Mini DV Tape**

| | | | |
|---|---|---|---|
| AY DVM-30 | 5.49 | AY DVM-30 (10 Pack) | ea. 5.99 |
| AY DVM-60 | 5.99 | AY DVM-60 (10 Pack) | ea. 6.49 |
| AY-DVM80 | 12.99 | AY-DV123EB | 20.95 |

**DVCPRD**

| | | | |
|---|---|---|---|
| AJ-P12M (Medium) | 7.99 | AJ-P24M | 9.99 |
| AJ-P33M | 11.49 | AJ-P66M | 19.49 |
| AJ-P66L (Large) | 20.99 | AJ-P94L | 29.99 |
| AJ-P126L | | | 38.95 |

### SONY

**Hi-8 Professional Metal Video Cassettes**

| | | | | | |
|---|---|---|---|---|---|
| P6-30 HMPX | 4.79 | E6-30 HMEAD | 6.99 | | |
| P6-60 HMPX | 6.79 | E6-60 HMEAD | 9.99 | | |
| P6-120HMPX | 8.99 | E6-120HMEAD | 13.99 | | |

**PR Series Professional Grade VHS**

| | | | | | |
|---|---|---|---|---|---|
| T-30PR | 2.39 | T-60PR | 2.59 | T-120PR | 2.79 |

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

| | | | | | |
|---|---|---|---|---|---|
| T-30BA | 3.69 | T-60BA | 4.19 | T-120BA | 4.99 |

**MQ Master Quality S-VHS (In Box)**

| | | | | | |
|---|---|---|---|---|---|
| MQST-30 | 7.49 | MQST-60 | 7.69 | MQST-120 | 7.99 |

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

| | | | |
|---|---|---|---|
| KCS-10 BRS (mini) | 8.99 | KCS-20 BRS (mini) | 9.99 |
| KCA-10 BRS | 8.99 | KCA-20 BRS | 9.49 |
| KCA-30 BRS | 10.69 | KCA-60 BRS | 14.99 |

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

| | | | |
|---|---|---|---|
| KCS-10 XBR (mini) | 9.79 | KCS-20 XBR (mini) | 11.29 |
| KCA-10 XBR | 10.29 | KCA-20 XBR | 11.79 |
| KCA-30 XBR | 13.29 | KCA-60 XBR | 17.39 |

**BCT Metal Betacam SP Broadcast Master (In Box)**

| | Single | 10 Pak/Ea. | 50 Pak/Ea. |
|---|---|---|---|
| BCT-5M (small) | 10.99 | 9.99 | 9.19 |
| BCT-10M (small) | 11.49 | 10.29 | 9.79 |
| BCT-20M (small) | 12.99 | 11.49 | 10.99 |
| BCT-30M (small) | 13.49 | 12.49 | 11.99 |
| BCT-30ML | 13.49 | 11.89 | – |
| BCT-60ML | 20.99 | 19.99 | 18.99 |
| BCT-90ML | 30.99 | 28.99 | 27.99 |

**PDV Mini Series Professional DVCAM Tape** (w/memory chip)

| | (1) | (10) Ea. | | (1) | (10) Ea. |
|---|---|---|---|---|---|
| PDVM-12ME | 14.49 | 13.49 | PDVM-22ME | 15.19 | 14.49 |
| PDVM-32ME | 15.49 | 14.99 | PDVM-40ME | 16.99 | 16.49 |

**PDV Series** (Standard) **Professional DVCAM Tape**

| | | | | | |
|---|---|---|---|---|---|
| PDV-34ME | 24.99 | 23.99 | PDV-34N | 20.99 | 19.49 |
| PDV-64ME | 27.99 | 26.99 | PDV-64N | 24.99 | 26.99 |
| PDV-94ME | 32.99 | 31.49 | PDV-94N | 29.99 | 28.49 |
| PDV-124ME | 38.49 | 37.49 | PDV-124N | 32.99 | 31.99 |
| PDV-184ME | 46.49 | 44.49 | PDV-184N | 39.99 | 38.99 |

**Mini DV Tape**

| | | | |
|---|---|---|---|
| DVM-30EXM w/Chip | 12.79 | DVM-60EXM w/Chip | 16.99 |
| DVM-30EX "No Chip" | 11.99 | DVM-60EX "No Chip" | 12.99 |
| DVM-30PR "No Chip" | 7.99 | DVM-60PR "No Chip" | 9.75 |

**Full Size DV Tape with Memory Chip**

| | | | |
|---|---|---|---|
| DV-120MEM | 24.99 | DV-180MEM | 26.99 |

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### G4/Final Cut Pro — Complete Video Editing Systems

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Includes: • Apple G4/466 Computer
• Final Cut Pro version 2 editing software
• Total of 256MB of memory
• 60GB of ATA/100 storage
• CD-RW rewritable CD writer
• Final Cut Tutorial CD
• Mitsubishi Diamond Pro 2060 22" Monitor
• Apple Care-three year warranty
• Complete System integration and testing

**$4,599.95**

#### Great System
Includes: • Apple G4/533 Computer
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• 60GB of ATA/100 storage
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• CD-RW rewritable CD writer
• Artel Boris Graffiti CG Program
• Final Cut Tutorial CD
• Mitsubishi Diamond Pro 2060 22" Monitor
• Apple Care-three year warranty
• Complete System integration and testing

**$5,299.95**

#### Best system
Includes: • G4/533 DUAL Processors
• Final Cut Pro 2 Editing Software
• 150GB (2x75) of ATA/100 storage
• Sonnet Tempo Raid 66 IDE Controller
• ATI Rage Drion dual display card
• Total of 256MB of memory
• Artel Boris Graffiti CG Program
• Final Cut Tutorial CD
• 2 Mitsubishi Diamond Pro 2060 22" Monitors • CD-RW writer
• Apple Care-three year warranty
• Complete System integration and testing

**$7,599.95**

#### DVD Authoring system
Includes: • G4 with 733 MHz Processor, 60GB Hard Drive.
• DVD-R/CD-RW SuperDrive
• Total of 512MB of memory • Built-in Gigabit Ethernet
• 150GB (2x75) of IBM ATA/100 storage
• Sonnet Tempo Raid 66 IDE Controller Card
• Matrox RTMac Realtime Capture Card
• Final Cut Pro 2 Professional Editing Software
• Apple DVD Studio Pro DVD authoring software
• 2 Mitsubishi Diamond Pro 2060 22" Monitors
• Artel Boris FX 5.0 Software • Post-Op iMedia Keyboard
• Artel Boris Graffiti Character Generator Software
• Pinnacle upgrade to Commotion DV 3.1
• Apple Care-three year warranty

**$10,999.95**

### matrox Digital Video Solutions — RTMac
#### Realtime Editing for Mac G4 & Final Cut Pro

Matrox RTMac brings realtime power and creative freedom to Apple Final Cut Pro users. A Matrox RTMac in your Apple Power Mac G4 lets you work with three layers of video and graphics in real time and create broadcast-quality effects instantly — NO RENDERING! Fully optimized for Final Cut Pro and seamlessly integrates into Power Mac G4 computers. Realtime creativity Realtime editing lets you experiment to your heart's content. There's no penalty for changing your mind. Try out any number of different effects and transitions. View them instantly on your computer and video monitors simultaneously. Get exactly the look you want every time.


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### PINNACLE SYSTEMS — CineWave
#### Uncompressed Editing for Final Cut Pro

Revolutionary non-linear editing package that delivers the power of true uncompressed video with Apple's Final Cut Pro. Using Pinnacle's new HUB3 video processor, the CineWave combines infinite layering, incredible effects, advanced compositing tools and accurate motion tracking with all the major video formats in compressed or uncompressed video. Based on the new dual processor Apple G4's, CineWave delivers the worlds first scaleable desktop video system capable of outputting both Standard Definition and High Definition simultaneously.


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### matrox Digital Video Solutions — DigiSuite LX

#### Advanced Realtime Features

*DigiSuite LX board offers more realtime features than any other product on the market. You get multiple 2D DVE processors, multiple channels of YUV color correction, independent transparency control on all layers, 32-bit animated graphics, two advanced chroma/luma/matte keyers, a customizable wipe/tile generator, variable speed motion control, and perfect audio sync. You can also add a 3D DVE channel with the MAX option.*


DigiSuite LX offers all the great features of the best-selling Matrox DigiSuite platforms, plus DV, MPEG-2, and 1394 support. DigiSuite LX provides native DV and MPEG-2 editing under Windows 200
• Award-winning realtime feature set
• Native-DV and 50-Mbps MPEG-2 editing
• 4 in/4 out, balanced/unbalanced analog I/O
• Audio clock genlocked to video reference ensures perfect synchronization in accordance with SMPTE-272M and AES11-1991
• MPEG-2 output for DVD and CD authoring
• 1394, analog component, Y/C, and composite support built-in • Integrated web video creation tools
• Field-proven, reliable technology

**SDI Option**
• Provides serial digital (SDI) video and AES/EBU digital audio I/O

### DigiSuite Turnkey System

- Pentium III 866 processor • 300 watt Full tower
- Asus CUSL2 motherboard • 3.5" floppy
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- IBM 30GB System drive • Windows 2000
- PNY 256MB SDRAM memory
- Matrox G450 Dual Display Card
- Adaptec 29160 LVD-160 SCSI Card
- Seagate 73GB LVD-160 SCSI Drive
- 102 Button Keyboard
- Microsoft Trackball mouse
- Adobe Premiere 6.0 Editing Software
- 19" Mitsubishi Diamond Plus Monitor
- 90 day Free Tech Support
- Fully assembled and tested

**$5,999.00**

### Avid — Xpress DV 2.0
#### Powerful Video Editing Tools

Avid Xpress DV software combines powerful video and audio editing tools, digital mastering, and extreme ease of use. Captures and edits DV video, adds effects, mixes audio, and outputs over IEEE1394 FireWire. Or transcodes the content to all major new media formats. MPEG-1 (for CD-R) MPEG-2 (for DVD-ROM) QuickTime or AVI for computer based presentations or for streaming on the web. As a member of the Avid Xpress Family, The Xpress DV 2.0 offers the same Avid graphical user interface (GUI) used in the very high-end avid products. powerful audio and video tools. • Dual monitor support • New audio features • Improved nesting • Sonic AuthorScript • Customizable UI, keyboard and command palate.

**$1,499.95**

### DELL — Xpress Workstations
#### Workstation Bundles

*Shown with optional Monitor*

***Express DV on Dell Precision Workstations***

- Pentium III 866 MHz / 1 GHz CPU/1.4 GHz (P-IV)
- 128mb/256mb RIMM (RDRAM) memory
- Matrox G450 32mb Graphics Card
- 20GB ATA100 IDE (7200 RPM) System Drive
- 40GB ATA100 IDE (7200 RPM) AV Drive
- 48X IDE CD ROM Drive • 3.5" Floppy Drive
- Windows 2000

XPress DV software loaded and tested

*Precision 220 Workstation*
*866 MHz Processor, 128mb RDRam* **$3,499**

*Precision 220 Workstation*
*1 GHz Processor, 256mb RDRam* **$3,999**

*Precision 330 Workstation*
*1.4 GHz Processor, 256mb RDRam* **$4,399**

### Portable Solutions
#### Portable NoteBook Outfit

- Dell Latitude C600 Pentium III 750 MHz Processor
- 256mb memory
- 14.1" Active Matrix TFT screen
- 20GB system drive
- 75GB Extenal AV Drive
- LowePro Carry Case

• XPress DV software loaded and tested

**$5,199.95**

**Upgrade to Avid Express DV v2 Power Pack** ($4200 Value)
Additional software to above outfit including Avid ePublisher Companion, Pinnacle Commotion DV 3.1, Knoll Light Factory AVX, DVDit! SE, Stabilize Effect AVX, DV Filmaker's ToolKit with purchase of any outfit .....$1,000

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**MAINTENANCE ENGINEER**: FOX O&O, AUSTIN, TX, Engineer needed to install, maintain and repair television broadcast equipment. Three years broadcast maintenance experience required. Sony Betacam SP experience required. News station and transmitter background helpful. Need creative individual to help with our upcoming DTV conversion. Associates Degree, SBE certification desired. Send resume and cover letter to Human Resources, FOX-7/KTBC, 119 E. 10th Street, Austin, TX 78701. Ref. position title on envelope. No phone calls, please. EEO Employer.

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**TRANSMITTER ENGINEER** - WSMV-TV, Meredith Corporation in Nashville, Tn. has an immediate need for a fulltime engineer to replace a retiring transmitter engineer. Must have a minimum of 5 years experience repairing transmitters. Background in studio repair would be a plus. Send resumes to the following address; Human Resources Department, WSMV-TV, 5700 Knob Rd. Nashville, Tn. 37209. EOE.

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**BROADCAST MAINTENANCE ENGINEER:** Broadcast Engineer needed for National News Network in Washington DC. Extensive background in broadcast equipment maintenance. Team leader, minimal supervision, good communication skills. min 5 yrs experience. Digital knowledge a plus. Competitive salary and excellent Benefits. Fax resume, letter c/o Eng. Manager 202-515-2217. Email John.Cunha@turner.com

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EOM

# Know thy audience

BY PAUL MCGOLDRICK

The first thing that any business needs to do is to establish who is going to use its products. There is absolutely no point in designing anything unless you also know the user, how the user will want to work with it and whether the user is going to pay you what you think it is worth. Manufacturers advertise in *Broadcast Engineering*, for example, because they know the readers make decisions in the purchase of their type of equipment. The same manufacturers might also advertise in a major financial publication so that the investment community understands the corporate directions the companies are taking. But those manufacturers are not going to advertise in a comic book, for example: wrong audience, wrong message and wrong product.

These basic facts don't seem to be universally understood, however, and particularly not in the broadcast/entertainment community.

Take Internet radio, for example. When you listen to your favorite station – maybe because it carries your alumni football games, or perhaps it was where you were raised – what do you hear in the advertising that is appropriate for you, the Internet listener? I'm sure you get commercials for local pizza or a used car lot that really is making the best deals ever, but do you ever hear national advertising? No. They might take a lesson from nationally syndicated talk radio, which has clearly identified that although local stations might broadcast some local advertising, the real money is being made by the national advertising. Radio stations that provide a feed on the Internet and have a statistically significant national audience would do well to re-think the old truism that radio's strength is its "local" nature. Not true on the Internet.

The same confusion comes across on the TV airwaves. There are some stations that know they have national audiences and have addressed that fact since their inception – the name Turner comes to mind, and WGN in Chicago has been on national cable systems long enough that it seems to have gotten the message. But others seem to have either missed the boat or just ignore it.

**There are some stations that have addressed their national audiences since their inception, but others seem to have missed the boat.**

A new group of superstations has emerged with satellite TV. The four – WPIX, KWGN, WSBK and WWOR – have a huge following outside their respective geographical areas, but you wouldn't know it from their websites. For example, WSBK doesn't even use its call letters for its URL, and WWOR prefers its New York upn9 slogan. They address their local communities only. They may feel that they have an obligation to their licenses, but they can surely do that at the same time as picking up a lot more nationwide loyalty. It is an incredibly wasted opportunity.

The ultimate lack of recognition of the product that these stations carry was probably demonstrated by KWGN in Denver. On a recent Saturday evening the station pre-empted the penultimate episode, ever, of *Xena, Warrior Princess* to carry live pictures of crowds gathering in downtown Denver after the Stanley Cup Final. This was not a riot situation, just a bunch of people gathering in the streets – crowds that probably increased in size when the live coverage by this and other Denver stations encouraged them to seek their moment of fame. Was it news? Nothing had happened of any consequence, so it probably wasn't by most people's definitions.

Here, station management clearly demonstrated that they are ignorant of their market. Yes, there is probably considerable pressure on the station to be a "local news" outlet and they have a particular percentage of the audience targeted for advertising, but the people who tuned in to that station at that time on that Saturday were not people looking for news of downtown Denver or hockey results. I would bet, however, that they were frustrated – and that's not a good way to treat your viewers, especially when they have the choice of watching the same programming at another time on one of the other super UPNs or WBs. In fact, the satellite audience that was potentially ticked off by the ego-news coverage of the station is clearly in excess of the population of Denver.

If you're taking advantage of new technologies, be they streaming radio or satellite broadcast, to reach an audience beyond your own area code, you'd better work on establishing whom your new constituents are and what their demographics are. Then work out how to deliver a product that they want and yourself the advertisers to best support it, or you might as well be taking out space in comic books. ■

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


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