DTV Update

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- New IOTs
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Today it's the news at 6:00.
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Systems Design & Integration

ON THE COVER: Baltimore, MD. is home to WBAL's, WJZ's and WMAR's new DTV/NTSC stacked antenna systems. This historic tower was the first three-antenna candelabra in the world when it was built in 1959. Photo courtesy of Dielectric Communications.

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FREEZE FRAME

A look at the technology that shaped this industry.

1/4-inch VTR

"One of the most promising technologies" of the 1983 NAB convention was the new 1/4-inch VTR format. Two companies displayed working versions of the format, including field editors and detachable camera/recorder units. Hint: one company called its product the "Quartercam." Name the two companies. Correct entries received by Aug, 31 will be eligible for a Broadcast Engineering t-shirt. Send entries to brad_dick@intertec.com.
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**Tom Lookabaugh**
*President, DiviCom*

This merger is great for our customers, great for DiviCom and great for Harmonic. Our customers know the DiviCom name as being synonymous with open solutions for digital television. They'll soon know us as Harmonic, and because of the merger, they'll get access to even more solutions and resources to meet their broadband needs.

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**Tony Ley**
*CEO, Harmonic*

“People around the world are demanding better and easier ways to communicate. Access to information is changing the way we live. Harmonic and DiviCom are joining forces to enable this new era in broadband communications.

Whatever the network, Harmonic will work with operators to build the infrastructure that makes the information age possible. And we will deliver the best technology and customer support the industry has to offer.

I look forward to service providers embracing our new company. Our customers can continue to expect the world-class broadband solutions they need to bring new services to market faster.”

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Is your station going dark?

Want to increase your coverage area by three, four or even 1000 times? How much RF would that take? Maybe a few gigawatts? What if you could do it for $50,000 or even less? Interested? I’m about to tell you how.

Streaming media is the current hot button on Wall Street. At last month’s Streaming Media conference in New York, more than 13,000 broadcasting newbies gathered to check out the latest in streaming technology. Attendance was three times last year’s number. There were twice as many exhibitors as the year before. Granted, this show has more smoke and mirrors than a magician’s convention, but this new industry is still one to be reckoned with.

Let’s look at some numbers. The Internet Research Group says streaming media services will grow by 20 times in the next three and one-half years. Total revenues by 2004 will be $2.5 billion – that’s a 2.5 with eight zeros behind it. Now you’re getting an idea of how large this behemoth really is. And the number of users is growing rapidly, too.

According to Digital Technology Consulting, more than 11.3 million homes will have high-speed Internet connections by next year. That breaks out to almost eight million with cable modems and four million with DSL. The In-Stat group says some 49 million homes will have broadband service by 2004. Are you convinced that there’s a new audience for your signal yet?

In my little burg, a start-up company called Digital Access just inked a deal with the city fathers to supply cable, Internet and telephone services via fiber. There are currently more crews installing fiber in Kansas City than flies at a picnic. The work represents a direct overbuild of two familiar monopolies, Time Warner and Southwestern Bell. Now we’ll have some competition. Just watch the formerly sole providers react to the new competition with lower prices and improved services.

I liken the placement of a signal on the Internet to what Ted Turner must have thought about when he considered putting his unknown station, WTBS, on satellite for distribution by cable systems. He didn’t say, “Why would I want anyone outside my terrestrial coverage area to watch my station?” Instead, he said, “How can I get my signal to the millions of viewers outside Atlanta?”

Stations that think their audience stops at the city limits are missing a great opportunity; they just don’t know it. With the Internet, there is no defined service area. Your service area is as big as you want to make it. With streaming technology, it costs no more to cover the nation than it does your backyard.

So where does all this new technology, growth, competition and, most importantly, money leave broadcasters? It depends on your viewpoint. Some broadcasters have chosen to ignore the chaos outside the door, thinking it, like quad FM, will go away. It won’t. Stations that choose to ignore streaming media and other new data delivery technologies are already going dark. They just don’t know it yet.

Brad Dick, editor

Send comments to:
direct: brad_dick@intertec.com
website: www.broadcastengineering.com
Solving the Digital Puzzle

Think Big, Choose Small

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The picoLink

Miniature Interfaces

Community towers

Dear Brad,

Your editorial (“Working together for community towers,” April 2000) presents compelling reasons to colocate DTV towers. DTV is exciting and has the headroom for functions and services way beyond HDTV. But it’s still subject to the same physics of RF propagation we’ve all grown to know and love for 50 years, including those pesky things like antenna aperture gain and beam width.

The CEA AntennaWeb.org program simplifies receive antenna selection. I’m glad you found it useful to ID the type of antenna your soon-to-own-HDTV-set friend needs. If it predicts a rotor is needed, it’s for the good reason you point out — lack of tower collocation. The site is a great (and free) tool not only for BE readers but also for the general public. More and more receive antennas are coming on market marked with the CEA antenna selector logo indicating their corresponding type. I’d be interested in other readers’ experiences.

I agree using rotors in the DTV world is cumbersome, especially with lengthy signal capture/display latency, but there are alternatives. The obvious one is an “area special” antenna designed to receive diverse channels at set orientations. Another emerging approach is electronically steerable antennas. CEA’s R5 (antennas) committee is exploring this and other approaches and may even devise a DTV receiver/antenna interface to make it all automatic. Now THAT is exciting.

Ralph Justus
V.P., Technology and Standards
Consumer Electronics Association

Dubbing tape to CD

I have hundreds of hours of DAT recordings of our two-hour radio show. I’d like to transfer them to CD-ROM for archiving.

Can you suggest a simple method of doing this on a Mac? I’ve got the CD burner and access to all kinds of software, but what is the quickest way?

I’d like to dub the DAT in its two-hour recorded format and then separate each hour later onto individual CDs. Can you suggest a simple solution or point me in the right direction?

Ira Flatow
Host/Executive Producer - “Science Friday”
Stamford, CT

Ira:
Unfortunately, to my knowledge there is no quick way to transfer audio from an audio DAT to CD-R. (If you had audio files on a data DAT, it would be easy.) You have to record from DAT to a hard disk in real time, using a two-track audio recording program. Next, save a file for each hour of your broadcast, then go ready to burn the CD. I highly recommend using a Mac-compatible audio card with SPDIF digital I/O so you can transfer the audio to the computer in the digital domain. The procedure is exactly the same for Windows and Linux users.

Best wishes,

Steve Oppenheimer
Editor Electronic Musician

“The first transistor” contest winners

Last month’s contest resulted in a new record for number of entrants. While every entry identified the photo as the first transistor, there was some debate as to the actual date of the invention. Reader Bob Connelly at Wyoming Public TV provided a great resource for more information on the invention of the transistor at www.pbs.org/transistor/album1/index.html.

One note, several of the entries identified the first solid-state device as a Germanium transistor. Of course, the correct type name is Germanium. A partial list of this month’s winners follows. Each correct entry received a Broadcast Engineering T-shirt. This month’s contest question is on page 8.

Bob Connelly, Wyoming Public TV
Paul Hart, HBO
Tom Lahr, WOSU-TV
John Mazza, San Francisco
Vicki Kipp, Wisconsin Public Broadcasting
Karl Nitschke, Ponte Vedra Beach, FL
George Danner, WPEC-TV
Richard Crowley, Hillsboro, OR
Jason Mecklenburg
Gary Sharpe, SCOTTY Tele-Transport Corporation of the Americas
Ron Estes, KTLA-TV
David Budwash, WAGA-TV
Don Norwood, Hickory, NC
Jaime Ananko, Rochester, NY
Frank Anderson, Media City Teleproduction Center
Allen Harmon, WDSF-TV
John Szukdlarek, Sinclair Community College
Dale Lamm, Canton, OH
Mike Plott
Larry Price, KMEX-TV
More Forums

More Users

More Questions

More Answers

World Wide User Groups

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With over 300 forums dedicated to digital content creation professionals, it all comes together on DigitalMediaNet.com. DigitalMediaNet.com helps you stay in touch with the issues, products and opportunities that can give that all-important competitive edge. Professionals from around the world, representing every discipline in the digital media market, tune into our media channels every day. Whether you are looking for the latest news, reviews, industry trends, a place to buy or sell your new product or even a new job, DigitalMediaNet.com has a solution!

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Tuning in on DTV and decoding

BY LARRY BLOOMFIELD

The transition to digital television has problems at virtually every point along the delivery chain, from the pickup devices to the display device. There are many questions whether it’s wise to move to a completely different system or keep putting Band-Aids on the one we have decided to use here in the United States, 8VSB.

Except for the last couple of years, little effort has been made to improve tuner capabilities. Once a tuner receives digital bitstreams and modulates the bed as a matter of cleaning up those bitstreams, irrespective of the form of modulation, they can be decoded and their various aspects to their proper use.

The distinction between the different generations of chips that grace the front-ends of the digital television tuners is somewhat blurred at this point. The problems have been many. Motorola’s Frank Eory says, “Debugging an application like this, at least to the point of discovering where it is ‘breaking’, would not take long. Fixing the problem is another issue.”

A joint venture between ATSC, the Consumer Electronics Association (CEA) and test station WHD-DT in Washington, D.C., conducted tests for television set manufacturers on June 1. According to George Hanover, independent consultant for CEA, the manufacturers of both encoders and decoders were invited to attend. Each set manufacturer wishing to test out the various parameters of their decoders were cloistered in separate rooms or suites. The encoder people were at WHD-DT and, when all the receiver folks finished with one encoder, Hanover would cue the encoder folks to switch to a different encoder, until each had their opportunity to be online and be tested.

Although the media was not invited and most everyone involved at ATSC, CEA and WHD-TV declined comment, the off-record conversation was that these individuals didn’t think the tests would have been attended if the results were made public or shared. C. P. Patel, a noted authority in the area of television front-ends and a 20-year veteran of Sarnoff Labs, said this information had to be shared, otherwise the tests would have been worthless as far as the encoder manufacturers were concerned.

According to one participant, there is no test equipment available on the market at this time that can replicate the real-life conditions of terrestrial digital broadcasting. This unique opportunity should have proven very beneficial to all parties concerned.

Another issue is a list of requirements a consortium of broadcasters has submitted to the ATSC. It would seem that the well-trusting broadcasters should have had that list in to the ATSC long before all these standards for the nation’s digital television system were to be cast in stone.

Eory in his comments on the broadcasters’ requirements stated: “Under existing law, DTV broadcasters must transmit 8VSB signals with the defined ATSC framing structure.”

Eory further stated if the ATSC is going to solve multipath problems, the digital framing structure must be
"To uplink 8 video feeds from the White House lawn, we put all our eggs in one basket."

When Taurus Communications got the call to provide the DSNG link for the White House 2000 Easter Egg Roll, it was apparent that the task would not be easy. Eight simultaneous video feeds were needed from a single truck, and no retakes were possible. This had to be a one-take, 8-feed, perfect satellite broadcast that could be distributed by internet streaming video around the world.

Taurus president, Dudley C. Freeman, says it best, "I knew we had to have equipment that we could count on, no matter what, so I turned to Tiernan and their THE1 HDTV/SDTV Encoder. There is simply nothing better on the market today."

THE1 is a high-performance, modular MPEG, ATSC and DVB compliant encoder. Its future-proof, modular design makes it easily adaptable to changing requirements in contribution and distribution via satellite and terrestrial networks.

So, no matter what your area of digital broadcasting, when you need the kind of performance and reliability you can count on every time, put your eggs in Tiernan's basket, too.

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modified to accommodate a few additional data segments per data field, so better "training signals" can be provided for initializing the parameters of the adaptive filter used for equalization and ghost suppression. There are those, however, who take issue with this philosophy saying that adding three data segments per field results in a one percent loss in channel capacity.

However, Eory argues that without better training signals, the initialization requirements on the adaptive filter used for equalization and echo-cancellation are exceptionally difficult, especially for certain complex echo ensembles.

It would be an understatement to say that in the past most engineers underestimated the multipath problems DTV would encounter. The AHG addressing these broadcaster requirements has determined that the failure of current 8VSB receivers to operate in the presence of multipath reception is intolerable.

There is argument that the gap between coverage and "receivability" must be narrowed. The AHG on receiver performance is where solutions must be found for as much of the multipath reception problem as is possible.

In order to cope effectively with multipath reception problems, more information is needed in the transmitted signal to support adaptive filtering in the receiver. No one has offered concrete evidence to the contrary. Engineering cannot be predicated simply on hope. All the incremental progress reports become meaningless, especially if the progress subsides before acceptable "receivability" can finally be achieved. Solid suggestions on fixing 8VSB right away are needed if it is to be preserved.

Other issues continue to plague receiver manufacturers. CEA faithfully promised to deal only with the now famous Table 3, but nothing in the FCC rules says a broadcaster must adhere to them. If a broadcaster chooses a different scan or frame rate it's not uncommon to find that sets can't deal with any of these other rates. Some sets even have difficulty dealing with 720 lines.

Both organizations involved said that they were fully ATSC compliant prior to the change from 704 lines to 720 lines. They each supposedly performed the same change and only that change; going from 704 lines to 720 lines. The net result was that one set of bitstreams caused problems in the receive and the other didn't. Reports from those involved in this testing found that much more surprising and scarier than the fact that any receiver might have problems with 720 lines. It therefore appears not to be a 720 lines issue, but rather an encoder-compliance issue or a standard issue.

Eory said there are bitstream and encoder setting issues other than just those that relate to Table 3 and non-Table 3 formats. Motorola's MPEG decoder firmware team, after making changes, were "totally taken by surprise when the four local DTV stations went on the air and they found that with one of them, video was not decodable at all," he said.

The fix was relatively straightforward. After close scrutiny of the station's bitstream, it was discovered that this station was transmitting only P and B frames and no I frames. The software looks for an I frame to get started and never finding one, it never attempted to decode the video. Now that it is known that this situation can exist, chipmakers can deal with it.

The engineers at the Phoenix station in question said the condition was not intentional, because they were simply using the encoder the way it was originally set up for them.

It is apparent that fixes to the standard need to be addressed as these true-life scenarios come to light. Firmware upgrades can easily be developed to fix such problems, and Eory says that this would be one very useful application of those "extra bits" that are so far not being used for anything.

Although no specific tie-in was made with these problems, Sony, who announced in January that it would roll out six HDTV sets this fall, has announced it will delay the delivery "because of software problems and technical standards concerns." Sony executives say retailers have been notified that they will not deliver the products this year.

Vic Pacor, senior vice president for television and digital media products at Sony Electronics, said, "Software for the main set of chips inside the televisions is taking longer to finish than anticipated." Pacor also said that another factor was a recently announced standards-body review of the transmission method selected several years ago for digital TV signals.

Pacor said he wasn't sure when Sony would sell the new TV, which includes two tube-based and four rear-projection sets. Pacor did say that Sony expected little financial impact from the delay.

There are two main points that need to be considered. First, these issues are not based on the battle over modulation schemes. These are purely digital issues centered on MPEG encoding and other digital parameters. That's what the June 1 meeting in Washington, D.C., was supposed to be all about. Perhaps we need to rethink some of the bitstream construction irrespective of the modulation standard, simply as an insurance policy. It's clear that all the issues of even the bitstream encoding/decoding process haven't yet been resolved.

Second, a high-ranking executive at Sony said she had considered having the company install a giant antenna on the roof of its skyscraper in New York to get HDTV broadcasts for its showroom but found that the cost of providing a reliable signal was prohibitive. If Sony, which employs 100,000 engineers and technicians, could not get a reliable HDTV of its own, what chance do the rest of us have?

Motorola's Frank Eory said there are bitstream and encoder setting issues other than just those that relate to Table 3.
For nearly 100 years, Belden has been providing the world's most innovative wire and cable solutions for the world's most challenging applications. From the high-tech leaders who are shaping the business world of the future...to the state-of-the-art stadiums and athletic facilities...to the broadcasters that bring the world closer together...to the industrial applications that are ushering in a whole new age of productivity...Belden has the products that perform and the expertise to help you make the right decisions. Like to know more about who we've helped? Stay tuned. Better yet, contact us today at 1-800-BELDEN-4 or on the Web at www.belden.com. And let's talk about what we can do for you.
WCPX-DT to begin multicasting six channels

Paxson’s WCPX-DT will be multicasting six channels of network feeds for 24 hours a day.

The itinerary will be three channels of the PAX network, consisting of the local, central time zone on the primary feed with the East Coast and West Coast feeds on Channels 2 and 3 respectively. The other three channels will consist of the Worship network, Praise television network and the Total Living Network (TLN), a Chicago-based TV network, on Channels 4, 5 and 6.

Paxson says it wants local cable systems in the Chicago market to carry its digital local time zone feed on the same channel to all basic subscribers that the PAX analog station had been delivered to at that same time.

In other words, cable operators would substitute the primary digital channel for the current analog signal so that the primary digital signal is available to all cable company’s basic subscribers on the same channel where the analog signal resided. The other five channels being carried by WCPX-DT’s digital signal would be available on the digital portion of the cable system serving homes equipped with set-top boxes that could decode the additional information. It is Paxson’s intention that these additional channels will be available as free programming services as well. It would be necessary for the cable company’s digital set-top boxes to be equipped with channel mapping protocol (PSIP) to be able to retrieve the additional program material.

Lowell "Bud" Paxson said, "We’re proud to be at the forefront of digital broadcast technology. The launch of WCPX’s digital signal marks the beginning of our conversion of Paxson’s television station group to digital broadcasting. As we continue to upgrade each of our stations’ transmission facilities for conversion to DTV, we will be able to provide viewers with multiple digital channels of entertainment programming, as well as data transmission and e-commerce opportunities."

There’s little doubt in anyone’s mind that digital carriage is the key to the success of the implementation and acceptance of DTV. In this light, Paxson said, “It is the company’s goal to achieve must carry under the current 1992 must-carry law using the processes available to us and, if needed, to seek compromises to effectuate a digital must-carry plan, which I feel is an absolute requirement for the successful transition on a nationwide basis from analog television to digital television.” Paxson said this must-carry plan has been presented to members of the cable industry, the FCC and NAB.

It’s no secret that Paxson has a “strategic relationship” with the National Broadcasting Company (NBC) and carries some of its shows such as the game show "Twenty One," and weekly extended primetime coverage of “2000 U.S. Olympic Team Trials” leading up to this year’s Olympic Games in Sydney in September.

Paxson’s president and CEO Jeff Sagansky added, “The conversion of the company’s television stations to DTV opens the door to new and exciting opportunities for enhancing the quality and expanding the variety of programming networks available to our viewers. Digital television opens up new revenue streams for the company as we develop additional networks with our partner, NBC.”

Tech bits

Hardly a day goes by that someone doesn’t record a new method or technical advance that will impact broadcasting sooner or later. Here’s a brief look at some of the more notable announcements.

The Federal Communications Commission has announced it will be studying 90GHz band. The advantage of the super-high microwave frequency is its capability of extremely wide bandwidth systems. The impressive is the fact that the antenna for these devices is actually part of the substrate on which the final amplifier is also mounted. At these frequencies, even a speck of dust can take on the characteristics of a capacitor or an inductor, tuning the circuitry substantially.

Spray-on circuits

Researchers at Sandia National Laboratories have developed a process they call “intelligent spray-on materials” that have the potential to create self-assembling computer displays.

The material assemblies into circuitry, within milliseconds, as the material solidifies. When the undoped material is sprayed into preformed vias, waveguides solidify. By doping with molecules that recognize specific conditions, sensor arrays are instantly built.

This process is called “surfactant-templated silica mesophases.” The materials can self-assemble into photonic pathways. (Photonic is the quantum of electromagnetic energy, generally regarded as a discrete particle having zero mass, no electric charge and an indefinitely long lifetime.)

Jeff Brinker, project leader, senior scientist at Sandia and a professor at the University of New Mexico says:

The advantage of the super-high microwave frequency is its capability of extremely wide bandwidth systems.
Wouldn't it be nice to get a server that doesn't FORCE you to acquire new skills?

Introducing the Abekas 6000, the server you already know how to use.

If you want a flexible, scalable, exceptionally versatile digital audio video server that will help you well into the next century and gives you the control you want without so much as a whimper, look at the Abekas 6000.

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"By adding ligands that exhibit molecular recognition, we can literally spray on sensor arrays." (A ligand is an ion, a molecule or a molecular group that binds to another chemical entity to form a larger complex.)

Brinker's team has harnessed the tendency of detergent-type molecules to exhibit two phases with opposite reactions to water, one hydrophobic (water-repellent) and one hydrophilic (water-soluble). During evaporation, those molecules form spherical cavities called pores. For instance, a drop of the material dries to form a hollow "dome" and a line of the material dries to form a hollow "tube" flattened on its bottom side.

So far, Brinker's team has focused on fluids and gases that lead to existing sensor chips, such as for handheld chemical analyzers, but this is only a start. With the addition of ligands that exhibit molecular recognition, such as molecules that change color in response to the environment, spray-on sensor arrays can be produced.

Brinker sees a bright future for his development in microelectronics. His team's immediate plans are to concentrate on microelectronic devices that can spray directly onto flexible silicon sheets. Eventually, the team envisions spraying whole computer displays onto a flexible silicon sheet from a standard ink-jet printer using color composition software to mix the materials as appropriate for different parts of the circuitry. "With ordinary color composition software, we can mix them together in 64,000 different combinations," said Brinker.

No matter how alluring "spray-on computer displays" might sound, it will likely be many years before even simple active devices make it out of the lab. To get the ball rolling, Brinker said the team's next accomplishment will be to create passive circuits with characteristics that are difficult to obtain using conventional means. Brinker believes that the ink-jet mixing strategy can be used to create devices with dielectric coefficients much lower than can be achieved with conventional lithography.

**Solar disturbances**

Layer names like troposphere, ionosphere and the like have played a significant role in communications over the years. Ionosphere bounce has both helped and hindered worldwide communications. Hops across the Pacific have been performed using tropospheric scattered in the 300 to 400MHz range.

These and the other of the earth's layers are greatly affected by solar activity. Phenomena such as seeing KHOU-TV from Houston on the off-air receiver in Central Control at KCBS-TV in Hollywood stronger than its own (Hollywood's) transmitter approximately 19 air miles away, is the result of this kind of activity.

Since this kind of activity usually occurs with the cycles of the sun, they're not an everyday occurrence. It is why broadcast engineers need to be familiar with this phenomena so that once they are affected by it, or

**Hitachi is releasing its “rewritable” 4.7GB DVD-RAM this month.**

viewers call to report unusual circumstances, they are aware of a possible cause.

It wasn't too long ago that one of these solar incidents wiped out one of the satellites many stations relied upon for the regular feeds of syndicated material. The rest of us who were affected by that wipeout know it sure can put some mighty big holes in your program schedule.

The sun, like the Earth, has its seasons, but its "year" equals approximately 11 Earth years. This is referred to as the solar cycle. According to Larry Combs, Space Weather Forecaster for NOAA's Space Environment Center in Boulder, Colorado, this year, the year 2000, Solar Cycle 23 reaches its peak period of increased output throughout the interplanetary medium, the 96 million miles between the sun and Earth. These intense releases of energy come in the form of X-rays, electrons, protons, neutrons and gamma photons. They are released from the sun's magnetic field through violent explosions as solar flares or coronal mass ejections. More than a billion tons of matter at speeds of up to several million miles per hour is hurled through space carried in the solar wind, impacting any planets or spacecraft in its path. Severe storms can occur five times a year during solar maximum periods and even twice a year over the whole solar cycle.

The Earth's atmosphere and magnetosphere allow adequate protection, but solar storms do not go unnoticed. Energetic protons can reach the Earth in 30 minutes. These storms have and can cause havoc on our communication systems such as broadcast television and radio signals, long-distance telephones, cell phones, and pagers: widespread anomalous propagation problems with VHF, UHF and HF frequencies. Navigation systems can be affected causing delayed signals and tracking problems with Loran and GPS receivers. Satellites can encounter increased drag, causing them to slow and change orbit, and experience charging from the charged particles harming components on-board.

**Optical recording**

Almost everyone is familiar with the compact disc. Whether your experience with them has been as a storage device for data, programs and the like, or for musical enjoyment, the CD has certainly gained its place in today's society. The average "data" CD holds somewhere in the neighborhood of 650MB of material or about 74 minutes of the audio material.

Gaining popularity is the distribution of films or other visual material on what looks like a normal CD but whose capacity is in the vicinity of 2MB. There are some distribution agencies that considered utilizing CDs for distribution of their movies and syndicated programs. These digital videodisc or DVD normally holds about 2GB of compressed video and
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Hitachi-Maxwell has announced a 4.7GB large capacity DVD-RAM disc. According to Hitachi, this new DVD-RAM media “provides high-quality two-hour digital recording and large capacity data recording.” In addition to this, a small size (80mm) DVD-RAM disc for video camera views is also being released.

Hitachi is releasing its “rewritable” 4.7GB DVD-RAM this month. The disc holds up to two hours of digital recording or 4.7GB of computer data. In addition to this, a 2.8GB DVD-RAM disc for video cameras will be released next month.

This might not seem like such a big deal in big market television terms, however in smaller markets where costs are a constant consideration, the potential for device like this in news and or sports is certainly a very viable consideration.

It’ll be interesting to watch this new DVD-based camcorder technology to see if it catches on any better than the Avid/Ikegami hard drive camcorder models that were introduced a few years back. The two cases are not exactly comparable because the Cam Cutter was intended for professional broadcast ENG use while the Hitachi device is more aimed at the higher side of the consumer market. But again this is also not a very valid argument because we saw many S-VHS tape machines used both in the field and on the air at many small market television stations.

If you think that’s great, hold on your hats because a New York-based company, Constellation 3D, Inc. (C3D) has announced further product advances in the development of their fluorescent multilayer disc or FMD for use with current standard red laser technology. Red lasers are pretty much the standard and an inexpensive component used in virtually all CD and DVD players in order to access the data stored on the disc to be played.

C3D has developed the FMD media capable of much higher data storage capacity, on the same sized discs and that can be played on CD/DVD drives which have been subjected to “minor and inexpensive modification.” Single FMD discs for use with these red laser-based drives will have capacities up to 25GB. You could get nearly a whole series of syndicated half-hour shows on one disk.

C3D has designed this new media to be backward compatible for use on any disc drive that can play all types of CD, DVD and FMD media. It also provides C3D with a clear road map for production of removable digital storage media with high capacity applications beyond the reach of DVD (storing up to 9GB).

“Certain vertical market applications such as Digital Cinema players and Internet streaming servers will require higher capacities of over 70GB almost immediately and C3D will serve these markets using green and blue laser technology.

“We have extended our development efforts toward immediate exploitation of this 25GB red laser disc opportunity concurrently with our existing 100-plus gigabyte disc programs,” says Patrick Maloney, senior vice president of Business Development.
Remember, your digital signal is only as strong as its weakest link.

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FCC auction threatens stations on channels 59 to 69

BY HARRY MARTIN

Under a Congressional mandate, the FCC is going to auction off frequencies currently occupied by stations on channels 60 to 69. The FCC scheduled these auctions for May and June; however, concerns raised by both incumbent broadcasters and wireless interests prompted the FCC to postpone the auctions until September. Broadcasters operating on these channels have expressed concern that the new services that the FCC has proposed for this spectrum will cause severe interference to current operations. They are also concerned that the standard for protection of stations occupying the affected frequencies is vague or inapplicable to television stations. The would-be wireless applicants have expressed concern regarding a parallel action for mobile phone frequencies that may render the frequencies on channels 59 to 69 less valuable. The FCC is trying to reach a solution that will satisfy all parties by the Congressionally-imposed Sept. 30, 2000, deadline.

Applicants for new NTSC stations or NTSC allotments on channels 60 to 69 must still meet the July 17, 2000, deadline for amending their pending proposals (see Dateline, below). The postponed auction does not accelerate or extend the end of the transition period (Dec. 31, 2006) during which both NTSC and DTV channels assigned to 60-69 may continue to operate.

LPTV window announced

The FCC will accept applications for new LPTV and TV translator stations, and major changes to existing LPTV and TV translator stations, during an application filing window to be opened July 31 - Aug. 4, 2000. A “major change” in an existing station is a change in output channel or any change that would increase a station’s protected signal contour. Participation will be restricted to rural and small television market applicants to minimize disruption to existing LPTV and TV translator stations caused by the implementation of DTV. All technically conflicting applications received during the window will be subject to an auction.

Applications will not be accepted if they propose transmitter site coordinates less than 75 miles from specified city coordinates for 211 cities in large and medium television markets, with the exception of facilities that request a waiver of the geographic restriction. These requests must demonstrate that the proposed facility is completely shielded by terrain barriers, and the community it serves cannot receive signals from full-service TV stations licensed in any of the 211 cities. Alternatively, terrain shielding may be demonstrated using the Longley-Rice terrain-dependent signal propagation prediction method.

Court denies stay — EEO rules effective

The U.S. Court of Appeals denied a request for stay of the new EEO rules. The new rules went into effect on April 18, 2000. While denying the stay, the court put the underlying appeal on an expedited track. A decision will most likely be reached in the first quarter of 2001.

In the meantime, to comply with the new rules, all broadcasters with five or more full-time employees must immediately establish an EEO program, identify who in management will be responsible for implementation, and make certain the station’s EEO policies are both well-known and regularly reviewed for compliance. The rules also require that broadcasters provide the widest dissemination of information on new full-time positions to reliable recruitment sources. Broadcasters need to randomly check to ensure that their sources are providing qualified candidates and to remove or add sources when appropriate. Minorities and females should appear in all applicant pools.

Reports under the new rules will cover station employment units, which the Commission defines as a station or group of stations commonly owned in the same market that share at least one employee. On the anniversary of their license renewal filing date, stations must place an “EEO Public File Report” in their public files and on their websites. Every second month stations in designated states must file their Broadcast Statement of Compliance (FCC Form 397). (See Dateline.)

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

Dateline

The deadline to amend pending NTSC applications for channels 59-69 must specify channels below Channel 59 is July 17, 2000. Amendments must be in the form of rule-making petitions and propose channels that protect all pending or operating NTSC and DTV proposals and stations, as well as qualified Class A LPTV facilities.

Stations in the following states must place their annual EEO Public File Reports in their public files and on their websites on or before Aug. 1, 2000: California, Illinois, North Carolina, South Carolina and Wisconsin.

Under the new EEO rules, on or before Aug. 1, 2000, television stations in North Carolina and South Carolina must file with the FCC a “Broadcast Statement of Compliance” on new FCC Form 397.

Send questions and comments to: harry_martin@intertec.com
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NOAA's change in direction

BY JIM SALADIN, SENIOR ASSOCIATE EDITOR

The National Oceanic and Atmospheric Administration (NOAA) recently announced a change in the delivery protocol, the NOAA Weather Wire Service (NWWS), used to deliver National Weather Service forecasts to participating stations. Service improvement was the impetus behind the change. The new system is said to provide a "reliable and timely" warning delivery system, allows reception of graphics and has an improved GUI. A standard PC can be used to select and monitor weather forecasts. However, a change in NOAA's protocol equals a unilateral shift for broadcasters — change or lose service. Does this equal a capital expenditure to replace fully functional equipment? What are the alternatives?

To give us a better idea of what this means for broadcasters, we asked Leonard Charles of Television Wisconsin and Dennis Gourley of Texscan MSI to weigh in on this month's question, "What does the change in NOAA protocol mean and are there steps to be taken for the average station?"

Send questions and comments to: jim_saladin@intertec.com

Leonard Charles is the chief engineer of Television Wisconsin Inc. and is based in Madison, WI.
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How have changes in the NOAA delivery protocol affected the broadcast and cable industry through the years and where does it stand now?

In 1960, NOAA provided a text code called Baudo code at 150 Baud delivered via a dedicated 60mA telephone line to a special decoder. The forecast was a repeating string of all the forecasts for the entire country, and each area forecast had its own header followed by a close code.

Broadcast and cable television systems purchased character generators that were designed to interface with this code and contracted with a delivery service to automatically receive a specific NOAA forecast for display to their viewing audience. The NOAA forecast service provided by the U.S. Government is free, however the delivery service and the equipment to process the NOAA forecast is paid for by the television system displaying the NOAA forecast.

NOAA forecasts were changed to ASCII with the same header and stop codes and still utilized the 60mA wire service. The suppliers of the character generators were forced to change their software to accommodate the new protocol so that their character generators could continue to display the forecast information. When older character generators could not be retrofitted they had to be replaced.

Contel/GTE worked with NOAA and provided a satellite delivered NOAA forecast service. This new delivery service provided for wider bandwidth and faster baud rates, which increased the amount of information that could be delivered. This new service caused character generators to be replaced or be retrofitted and the broadcast cable system now had to buy a separate satellite dish and custom receiver to receive the new NOAA feed. Hardware costs for this service were approximately $1500 along with an annual service contract.

As of August 2000, the NOAA delivery services will change again requiring a new satellite dish and receiver at a cost of approximately $6000 along with an annual contract fee. The character generators the stations own are not likely to work with this new service, and again their character generators may needed to be replaced or be retrofitted.

A station desiring to continue to automatically receive and display NOAA forecasts should check with its character generator manufacturer to see if their system will interface with the new NOAA delivery protocol or if it provides an upgrade for its equipment.

Texscan MSI is now providing an alternative NOAA delivery solution. Any future changes made by NOAA will be processed on Texscan's NOAA data server so that the data delivery to their character generators will always be compatible.

Dennis Gourley is consultant with Texscan MSI, Salt Lake City.

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Motion Compensated Standards Conversion
Data multiplexing

BY MICHAEL ROBIN

We live in a global village where communications play an important role. To be relevant, communications must be reliable, accurate and nearly instantaneous. Communications are translated into analog or digital data, which are sent using a transmission medium. The transmission medium, be it air (or lack of it as in vacuum), copper (as in bifilar or coaxial cable) or glass (as in fiber optics) is a precious commodity. Since the beginning of the modern age, the telecommunication industry has sought to maximize the data throughput of the transmission medium. The various methods used fall under the umbrella of data multiplexing.

Analog multiplexing

Analog multiplexing has been with us since the 1930s when the rapid increase in telephone traffic required the development of techniques allowing for the simultaneous transmission of multiple channels on a single tele-communications medium. The method used was frequency division multiplexing (FDM). One of the most successful applications of FDM will likely be unusable in the U.S. in 2006.

One of the most successful applications of FDM will likely be unusable in the U.S. in 2006.

We are talking, of course, of the frequency interleaving of the chrominance and luminance information resulting in the composite NTSC video signal. This process allows the simultaneous transmission of luminance and chrominance values in a 4.2MHz bandwidth. The system takes into account the discrete spectrum clusters of the luminance signal with a spacing of Fh/2 (horizontal scanning frequency) and inserts equally discrete but Fh/2 displaced spectrum clusters of a suppressed carrier quadrature modulated signal conveying the color-difference B-Y and R-Y information. The chrominance spectrum displacement by Fh/2 is achieved by using a chrominance subcarrier whose frequency is a multiple of Fh/2. The chosen subcarrier frequency is Fc = 455Fh/2 = 3.58MHz. The result is an interleaved spectrum with chrominance and luminance clusters spaced Fh/2 as shown in Figure 1. While frequency division multiplexing is a relatively easy task, demultiplexing is relatively difficult to achieve. A perfect decoder requires complex filtering and separation of the luminance and chrominance spectral components. Unavoidable design compromises result in chrominance-to-luminance and luminance-to-chrominance crosstalk. In addition, less than ideal transmission-channel characteristics result in high frequency delays, resulting in chrominance vs. luminance delays and nonlinear distortions, resulting in differential phase and differential gain, which affect the accuracy of the color rendition.

Digital multiplexing

Digital multiplexing uses the concept of time division multiplexing (TDM). Here several related or unrelated signals are sampled at a rate high enough to ensure that no information is lost. The samples are shortened (relative to the original sample rate) as required and are time division multiplexed for sequential transmission through a common medium.
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multiplexers interleave a number of lower speed signals to form a higher speed signal.

The advent of digital signal processing in studio environments has led to time division multiplexing of various data. The first TDM step in a studio environment is the sampling and quantizing of gamma corrected analog luminance (E'v) and scaled color-difference (E'cb and E'cn) signals. The latter are sometimes referred to as P1 and P2. Figure 2 shows a conceptual application of the CCIR 601 4:2:2 concept as follows:

• The E'v analog luminance signal is 5.75MHz low-pass filtered and sampled at 13.5MHz with a precision of 10 bits per sample. This results in a bit-parallel digital luminance signal (Y) with a data rate of 13.5Mwords/s. The words have a duration of 1/13.5MHz = 74ns. There are 858 Y samples per total scanning line numbered Y_0 to Y_857.

• The E'cb analog blue color-difference signal is 2.75MHz low-pass filtered and sampled at 6.75MHz with a precision of 10 bits per sample. This results in a bit-parallel digital red color-difference signal (C_r) with a data rate of 6.75Mwords/s. The words have a duration of 1/6.75MHz = 148ns. There are 429 C_r samples per total scanning line numbered C_r0 to C_r428. The C_r samples are collocated with every other Y sample (Y_0, Y_2, Y_4 ...).

• The E'cn analog red color-difference signal is 2.75MHz low-pass filtered and sampled at 6.75MHz with a precision of 10 bits per sample. This results in a bit-parallel digital red color-difference signal (C_n) with a data rate of 6.75Mwords/s. The words have a duration of 1/6.75MHz = 148ns. There are 429 C_n samples per total scanning line numbered C_n0 to C_n428. The C_n samples are collocated with every other Y sample (Y_0, Y_2, Y_4 ...).

Figure 1. Details of NTSC the FDM spectrum around the chrominance subcarrier.

Figure 2. Time division multiplexing of digital 4:2:2 data.
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There are a total of 1716 samples per total line (858Y, 429Ca and 429Cr) and a total of 1440 samples per active line (720Y, 360Ca and 360Cr). The horizontal blanking duration is equal to 1716 - 1440 = 276 samples. Horizontal sync is not sampled. Instead, two four-word Timing Reference Signals (TRS) are sent: one identifying the end of active video (EAV) and the other identifying the start of active video (SAV). This leaves an overhead of 268 horizontal blanking interval samples available for transporting other types of information referred to as horizontal ancillary data (HANC).

HANC data are formatted in packets consisting of a header, followed by the ancillary data and ending with a checksum (CS). In the absence of a header it is assumed that no ancillary data are carried. The header consists of six words. The first three, 000, 3FF, 3FF, values which cannot be assumed by other data, signal the presence of ancillary data. The following three words of the header are DID (data identification), DBN (data block number) and DC (data count). The ancillary data follow the header. A maximum of 255 words is permitted. Figure 3 shows details of the digital 4:2:2 horizontal blanking interval and the manner in which two AES/EBU digital streams require 8 x 3.072 Mb/s = 24.576 Mb/s, leaving ample HANC space for other ancillary data: 42.16 Mb/s - 24.576 Mb/s = 17.584 Mb/s. Ancillary data can also be embedded simply does not carry HANC data. This requires that the audio be de-embedded, processed separately and, subsequently re-embedded. This is cumbersome and costly, especially if we take into account the need to maintain lip-sync, which is lost in separate audio and video processing. The majority of the teleproduction community feels that digital audio and video should be processed separately and distributed in parallel. Embedding, if required, should be carried out at the end of the production chain for distribution and/or preset (non-live) switching.

Digital multiplexers interleave a number of lower speed signals to form a higher speed signal.

Audio data streams can be formatted to fit in one ancillary data packet. SMPTE Standard 272M defines means of multiplexing (embedding) up to eight AES/EBU data streams (16 individual audio channels) in the HANC data space. This is achieved by grouping the eight AES/EBU data streams into four audio groups. The HANC capacity of the 4:2:2 digital format is of the order of 42 Mb/s, which is obtained as follows:

268 words/line x 525 lines/frame x 29.976 Hz x 10 bits/word = 42.16 Mb/s.

Certain exclusions, such as lines 10 and 11, reduce this value by 10 percent to 20 percent. Given an AES/EBU data rate of 3.072 Mb/s (before BPM encoding), eight AES/EBU data streams require 8 x 3.072 Mb/s = 24.576 Mb/s, leaving ample HANC space for other ancillary data: 42.16 Mb/s - 24.576 Mb/s = 17.584 Mb/s.

Audio data can also be embedded.

Michael Robin, former engineer with the Canadian Broadcasting Corporation engineering headquarters, is an independent broadcast consultant in Montreal, Canada. He is the co-author of Digital Television Fundamentals, published by McGraw-Hill.
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As users, we rarely want to play a file from beginning to end. Almost every time we call for the output from a video file server, we are actually asking for a piece of material to be played from start of message (SOM) to end of message (EOM). There usually are a few frames of black at the beginning and end of the program or spot, and in most applications we do not want to see these frames. Almost all server manufacturers allow the user to select where playout begins and ends within a particular clip. However, there is some variation in just how precisely the user can specify the playback point.

While it would be natural to assume that all servers allow a user to specify an SOM down to the field, this may not always be the case. Some servers allow the user to specify SOM down to half a second or so, and many times this is more than adequate. Being able to specify an SOM to plus or minus four frames may meet most broadcasters’ needs. However, if you are trying to do cuts between pre-produced programs at a specific field or frame, you will quickly discover that this level of accuracy is inadequate. Why would a server manufacturer design a system that cannot specify SOM and EOM locations down to the frame? Many times this is a decision based upon performance. Access down to the field may mean an unacceptable decrease in system response. However, most server manufacturers now allow the user to specify playback down to the field or frame, so this is less of an issue.

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issue than it was in the past.

While plus or minus four frames might be perfectly acceptable in an on-air playback situation, you can imagine that post production requires that the user be able to predict a playback more accurately. In fact, it is very likely that being able to start playback at a particular field is not enough. Audio post production may require that the user be able to specify a playback as precisely as a particular audio sample. In a 48 kHz system, that means 48,000 sample points per second. When you consider that the server must uniquely identify each audio sample in reference to not only the incoming video, but to an internal clock which is locked to a video reference, you can see that some creative engineering is required to make everything work.

Decompressing MPEG

Now for the real challenge. Few MPEG systems store material on a frame basis. In fact, because of temporal compression, many of the frames are missing. You may recall that most MPEG encoders compress video in two ways - spatially and temporally. MPEG achieves temporal compression by sending a complete frame once and then only sending information about areas of the picture that have changed in subsequent frames. After a pre-determined amount of time a complete frame is sent again.

If a user requests a specific frame of video, that complete frame of video may or may not exist on the server. If the encoder created the complete frame, then the server need only retrieve the frame and display it. But what if the requested frame was a "I" frame, containing only predictive data about how the next frame should be constructed? In this case, the server can only display the requested frame by going back through previous frames until it finds a complete frame and then recreating the requested frame on the fly. This is a little complicated, but not really too hard to do. But there is still a bit of magic to be done. How does the server know where the nearest complete frame is?

The answer is by using an external index table. When an MPEG stream is recorded, the server builds an index table to keep tabs on the location of critical frames in the stream. Then, when a user requests a specific field or frame, the server can quickly build the frame on the fly using the index table as a reference.

BradGilmer is president of Gilmer & Associates and is executive director of the Advanced Authoring Format Association.

Send questions and comments to: brad_gilmer@intertec.com

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BY STEVE EPSTEIN, TECHNICAL EDITOR

I am looking for a basic book on audio and video engineering. I have a small to medium size post house (five suites) and I am about to move and install a machine room. I have a freelance engineer for this installation but his time constraints and my money constraints require me to handle many of the small issues myself. Can you recommend a good reference book? My main concern is the hook up of analog and digital decks through the A/D-D/A converters. Any suggestions are greatly appreciated.

Thanks,
Ken Skaggs
President, Frames Per Second
Dallas, TX

Dr. Digital responds:

Let's handle the simpler issue first. The A/D converters for tape machines can be easily handled with the VTR-100 from Miranda (it was featured as a Pick Hit winner in the June issue). It handles all the necessary conversions in a single box. Now, for the harder issue: a good reference book. The Ninth Edition of the NAB Handbook is good, as is Michael Robin's book "Digital Television Fundamentals." The problem with both books is that they will tell you everything involved and a lot more. However, they don't concisely tell you how to assemble a facility. Steve Lampen's book on Wire & Cable will tell you what you need to know for wiring, but there is no equivalent book for building a full facility. Much of the problem is that no two facilities are alike, and therefore there are no easy answers to the many questions that face someone trying to build a facility.

I have built several facilities and strongly recommend you plan everything carefully with your freelance engineer or someone else that is technically proficient. Here's why:

1. Mistakes made in the design will be paid for over many years to come.
2. Time spent in the planning stages will be saved during the buildout.
3. Skipping the planning will result in considerable wasted time and energy (and money) during the buildout.
4. It is a lot easier to move a wall 12 inches on paper than in the real world. This WILL happen somewhere in the project if it is not well planned.
5. If you can't afford to have the engineer do all the work, at least allow him to plan the facility. Pay his rates for a good design and then hire some lower-cost help to do the buildout to his specifications. Good luck, let me know if you need any additional help.

After sending Ken that response, I received the following:

Thanks for the response! I am definitely having my engineer design and install the new machine room. My issues are more with clients bringing in odd equipment with a project, leaving me to wire it into the room. I am trying to have spaces left open to just plug a machine in, but can't plan for everything. I need to learn the basics myself because I cannot justify a full-time staff engineer.

Dr. Digital responds:

Have your engineer wire a panel in a convenient spot (machine room or edit suite) that is just for connecting those odd pieces of equipment brought in by clients. Include video out, video in, audio in, audio out, machine control and genlock connections as well as necessary interconnecting cables. That way it is ready to go when you need it. If there is a call for more than one, have him build two or three. Make it a digital panel and throw in the Miranda VTR-100 and you are ready to hook up almost anything you need. Most clients that carry machines around know enough to set them up if they can simply point them in the right direction. Good luck.

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www.americanradiohistory.com
BY DAVE HIGGINS

The heavily used Oxygen Production Control Room (Producer's desk in the foreground) also serves as an On-Line Edit Facility. In edit mode, the TD position can operate the entire room. Equipment complement includes Sony DVS 7200 Production Switcher with Shot Box, DME 7000 Core 2 Digital Effects Generator and FX Deko Character Generator. Photos courtesy of The Systems Group. Copyright 2000 Melabee M. Miller.
The Systems Group recently completed construction of the Oxygen Media television studio facilities located in the Chelsea Market building complex in lower Manhattan. The initial design concept for the facility envisioned a DV-oriented, desktop production environment. However, Oxygen Media's broadcast strategy expanded the core facility requirements over the course of the project cycle. It quickly became apparent that office space would become a focal point for production backdrops and a more traditional, yet versatile, production control room would be needed. The facility's design focuses on production facilities that do not detract from its open, loft-like office space while maximizing the capabilities of hardware and systems. The success of the project depended upon these objectives being met while the Oxygen Media creative team, talent and production crews rehearsed in preparation for the Feb. 2, 2000, launch date.
Over time, design considerations were balanced against the need to maintain a workplace environment before, during and after live broadcasts from the facility. Conference rooms, cubicles and much of the work space environment are used as backdrops for show segments. Those segments are then packaged for use in the daily production of Pure Oxygen, a live broadcast that featured interviews, performances, pre-taped segments, impromptu chats with Oxygen staffers and a particularly strong focus on the Internet. To meet the demands of a live show, as well as minimize disruption to the surrounding office environment, the production crew and their equipment must move through the space as quickly and efficiently as possible.

Oxygen Media Engineering and The Systems Group developed a production plan for ambient lighting, acoustics, sets, crew movement, communications and the logistics of moving camera positions throughout an office space environment during a live broadcast. Broadcast service panels (BSPs), which are I/O panels with connectivity to various production systems, are extensively employed, integrating surface-mounted, custom-fabricated cable demarcation boxes in 14 different locations across two floors. All of the I/Os return back to jackfields in the Central Equipment Room for maximum flexibility. Camera triax connectivity is achieved through the use of mimitriax connectors and jackfields. The result is any CCU can be easily and quickly patched to any camera or BSP in the facility.

Technology and logistical considerations notwithstanding, an effort was made to blend the production infrastructure into the architectural elements of the Oxygen office space. In many facilities drop ceilings or raised computer flooring are common approaches to “hiding” coax, twisted pairs, CAT 5 and related interconnections from view. At Oxygen, the cable raceways are an integral part of the overall office space look and can be seen frequently on the daily broadcast of Pure Oxygen and Trackers as well as above, around and through the office environment.

Locating core production areas in close proximity was an important technical design goal for the project team. The need to minimize system cable runs, as well as centralize the activities of the primary production crew became a driving concern. To achieve the necessary results, the Central Equipment Room is located adjacent to the primary studio stage. Its placement requires 150 foot cable runs through the floor of Central Equipment Room, on cable trays through the seventh floor space and then to the rear of the Production Control Room monitor.

At Oxygen, the cable raceways are an integral part of the overall office space look.

The Production Control Room is directly next to the Audio Control Room and a small announce Room.

The technical immediately adjacent facility that Oxygen Media Engineering and The Systems Group were an integral part of was the DVS 128 router, equipped with a pair of Beta SP 500 routers and two channels of Ultimate Black Pearl PLX Deko and Leitch reference timecode systems and Sony Digibeta as the primary tape format. A Wheatstone SP 8 32x4x2 mixing console is employed in the Audio Control Room. A Mackie SR 40-8 console is located in the Trackers studio for sound reinforcement.

To achieve the post-produced “look” Oxygen sought in its live programs, several content acquisition methods were evaluated. Ultimately, miniDV, DVCAM and Beta SP were used as the remote platforms. There are both Avid and Media 100 nonlinear editing systems in use, as well as Apple’s FinalCut Pro software running on G4 Macs. Oxygen uses Drastic Technologies’ VVW 3000 and VVW 3500 digital video servers to translate and playback all three formats real time.

The Audio Control Room has a Wheatstone SP8 32x4x2 mixing console, ProTools 24 mix plus, Sony diversity WRR 840A UHF receivers, Tascam 40 MK II DAT, and 360 Systems 2730 Digicart.
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Production facility expansion

During the course of the project the Production Control Room design goals grew from relatively modest requirements to accommodating four hours of daily live production and producing short-form segments off-line throughout the day. To meet those demanding production goals, several factors were considered. First, the facility supports two separate studios with a total complement of 13 cameras. In addition, the Production Control Room must quickly and easily transform into an online edit suite. Finally, the Production Control Room is limited to a cozy 15-foot by 25-foot area. Space rapidly became a premium in the room and an aggressive plan was developed to use every unit of available rack space and console real estate as ergonomically as possible.

Time Base Consoles designed the rear producer’s desk so it accommodates four people on the rear desk and provides valuable rack space for jackfields, tape machines and supplemental audio equipment on its front side. The TD position has the Sony DVS 7200 production switcher/DME 7000 Core 2 digital video effects in the front desk, a removable Sony audio mixer 90 degrees to the right, and tape machines and jackfields 180 degrees behind it. This allows one person to “run the room” in an edit. By creating a breakaway connection for the mixer and placing it on a roll-around cart, the room quickly converts to its “on-air” configuration, giving the TD more space to operate during live productions.

Trackers studio

In November, the Trackers studio construction began, resulting in significant system expansion. The studio could not be located in any contiguous space in the existing Oxygen floor plan, so a site was selected in a different section of the Chelsea Market complex. The design goals were slightly different for this space, because it “piggy-backs” onto the existing Central Equipment Room, Audio Control Room and Production Control Room capacity in the core facility. To achieve the target on-air date, a second project team was chosen to implement the Trackers facility. The two teams worked together, completing the core studio construction and building the new studio in time for the Feb. 2, 2000 launch date.

Architecturally, the Trackers studio more closely resembles a sound stage environment and requires less consideration for the nearby office space. A Telecast Fiber optic system was selected to link the Trackers studio with the equipment and production rooms. Video signals, intercom, audio and return signal paths are transported more than 800 feet to the Central Equipment Room via fiber. The output SDI signals are then sent to jackfields and into the Sony router. The goal was to be able to change from one studio configuration to the other within a small operating window every day. Pure Oxygen is broadcast live from noon to 2p.m., and Trackers is on-air from 4p.m. to 6p.m. Since both studios are being used for live productions, transitions need to occur as seamlessly as possible. As a result, the technology deployed must allow fast and accurate changes over, without any noticeable signal degradation. The expansion of the minitrix patchbays and six BSS in the Trackers studio satisfied the video changeover goals while remaining consistent with the existing core studio.

To accommodate the need to place talent throughout the two studios and move camera positions constantly and quickly, both the core studio and the Trackers studio utilize a wide variety of wireless communication devices. Frequency coordination for the 24 Sony wireless microphones, 28 Clear-Com wireless PIs and 12 wireless IFBs in a relatively benign RF environment would be challenging, but implementing this platform in the heart of lower Manhattan presented a truly daunting task. The extensive use of these wireless systems allows for maximum flexibility within the studios, while allowing various groups of technicians, cameramen and producers to communicate seamlessly.

Launch day planning

The construction timeline for the facilities was nearly seven and a half months. This is an aggressive timetable when one considers that general
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construction was not substantially completed until the end of the fourth month in the project cycle and rehearsals began less than a month later. This meant that most of the on-site technology integration took place while civil works construction was being completed. In addition, core facilities had to be completed first so rehearsals could begin and a production schedule was established. Remaining systems integration was finished during off-hours and downtime. Close coordination among the various construction contractors, Oxygen technical and creative staff, and The Systems Group was key to successfully meeting the demanding project deadlines.

Oxygen Media went "on-air" the morning of Feb. 2, 2000. The first eight hours of programming were devoted to a single camera crew and producer walking throughout the core studio, Trackers facility and the Atrium of Chelsea Market providing a live and unrehearsed "behind the scenes" look at launch day. At the same time, a complete dress rehearsal was taking place for Pure Oxygen and Trackers.

The remote crew bypassed the core studio facilities by using the BSPs and minitriax jackfields to patch their camera feed directly to the outbound signal path. This allowed the first live broadcast out of the facility to occur while the rest of the production crew was using the Production Control Room, Audio Control Room and both studios to simultaneously rehearse in their respective spaces. The flexibility designed and built into the system allowed all three production elements to work independently from day one. [Picture of Trackers studio] 

David Higgins is director of project development for The Systems Group located in Hoboken, NJ.

**Oxygen Media Project Team:**
- Geoffrey Darby, president of production/convergence
- Andrea Cummis, vice president of engineering and operations
- Tom Burns, vice president of broadband technologies
- Alison Murphy, director of facilities

**The Systems Group Project Team:**
- David Higgins, project manager
- Bob Degnan, systems engineer
- Dave Stengel, assistant project manager
- Paul Rogalinski, integration manager
- Installation Crew:
  - Mattias Allevik
  - Alex Blanding
  - Darwin Clermont
  - Larry DeFazio
  - John Zulick

**Equipment List**
- Sony 64x64 SDI router
- Sony DVS 7200 production switcher with shot box
- Sony DME 7000 Core 2 digital video effects
- Sony BVP 550 and 570 cameras
- QTV teleprompters with AP News interface
- Pinnacle FX Deko character generator
- Pinnacle Lightning still store
- Drastic VVW 3000/3500
- Digital Disc Recorder
- Clearcom Compact-72
- Ultimate 9 Chroma keyers
- Wheatstone SP 8 32x4x2
- Mackie SR 40-8 mixing console

The Trackers studio located over 800 feet from the core production facility utilizes a Telecast Fiber Optic transmission system to provide interconnectivity to the central equipment room.
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Transmitter site safety

BY DONALD L. MARKLEY

It was a dark and stormy night, as the famous story goes. In broadcasting, that often leads to a transmitter going down with the customary smell of burnt carbon and charred wiring. The natural reflex, supported heavily by management and the programming department, is to get the thing back on the air as soon as possible. That often leads to the chief engineer or transmitter supervisor being called to venture out into the storm to make repairs. Often, by himself. Bad idea.

Don’t make the mistake of working on high voltage systems all by yourself. For this purpose, high voltage is anything above 24 volts. The most lethal voltage, based on the number of fatalities, is common 120V AC, primarily because it is everywhere and technicians are used to having it present. As familiarity tends to breed, at least carelessness, if not contempt, that voltage being present on terminal strips or internal transmitter components tends to be largely ignored. This can, in turn, lead to bad consequences. Many transmitters will have that voltage present in the cabinets even when the main breaker is turned off. A separate breaker often feeds the exciter and control circuits.

Avoid working alone

When making that panic trip to work on equipment, call someone else, almost anyone else, to be present at the site. That person should be shown how to power down everything, even if by pulling the main natural reflex upon seeing someone receiving a nasty shock, making strange noises and moving in unnatural ways, is to grab them to pull them out of the equipment. Another bad idea, because it can simply lead to two people demonstrating those characteristics.

It would be wonderful to have an assistant on site who is knowledgeable and who can make a real contribution to the repair process. If that is not practical, a warm body of almost any type will do as long as they are sufficiently smart to be able to pull a breaker and call 911. Administration of mouth-to-mouth would be a bonus. Remember that one of the first problems associated with severe electrical shock is temporary paralysis of the chest muscles. A little mouth-to-mouth action can keep all systems working until the paralysis has passed and normal breathing returns. A second problem from severe shock is ventricular fibrillation, where the heart seems to flutter rather than beat. Closed chest heart massage might be helpful, by a trained person, but more helpful is treatment with the appropriate equipment — the reason for 911. If nearby, medical treatment may arrive in a timely fashion to avoid your
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Snakes have a great tendency toward the investigation of openings such as cable entrances into buildings or leading to cable trays.

Unauthorized visitors

In another area of concern, nature's little creatures are all out and about this time of the year. Besides the fuzzy, loveable ones, there are the nasty crawly ones. Snakes have a great tendency toward the investigation of openings such as cable entrances into buildings or leading to lead one to forget electrical safety, especially if one is as upset by such occurrences as this author. A similar reaction may occur upon being greeted by bees or other groups of insects. Now that the famed killer bees are present in parts of this country, the problem is further aggravated. The solution is very simple. Good housekeeping and building maintenance will eliminate openings where such beasts might gather. Keep the building tight and closed to reduce the problems of animals.

We are reminded of an instance when a technician in western Missouri was vacuuming out an ATU doghouse in a directional array. Upon sensing movement above him, he saw a copperhead snake lying on the doorframe above the door. His first reaction was to place the end of the plastic tube on his shop vacuum over the snake's head upon which it was drawn into the tube until reaching the point where the girth of the snake exceeded the diameter of the tube. Now the problem was what to do with this closed system of snake and vacuum. The author would have performed a scientific experiment in which it could be determined if a shop vacuum motor would run until a large snake starved to death. The technician in this instance turned off the vacuum, pulled the snake from the tube and hit its head with a hammer. Bad choice, but he really wanted his vacuum cleaner back.

It is realized that dealing with snakes, insects and other animals really doesn't rank with working on a high voltage supply in terms of safety. However, it goes directly to maintaining a safe workplace with minimal hazards affecting working conditions. Cleanliness and a well-maintained building will relieve workers' concerns regarding minor issues and allow them to concentrate on the bigger issues.

Don Markley is president of Markley and Associates, Peoria, Ill.

Send questions and comments to: don_markley@interotec.com

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Audio for video — analog, digital or embedded?

BY MIKE BETTS

Many facilities use a combination of analog and digital audio signals when producing and delivering programs. New equipment may only accept or provide digital audio, and I/O signal conversion could be required if the existing analog infrastructure is to be used. Existing analog infrastructures still provide a useful method of connecting digital signals, but the conversion back and forth to analog introduces the drawbacks of analog into the digital path. The dynamic range of the digital path and the ability to interconnect digital signals without any loss are features that should be utilized whenever possible. When updating facilities to add digital audio, the use of embedded audio in the video channel should also be considered.

Changing paths to digital may not be economical, so the use of A/D-D/A conversion products and embedders and de-embedders warrants careful consideration. Picking a standard to conform to is one of the first requirements. With digital audio, the choice is normally the AES-3 standard. That standard, however, encompasses many variations and knowing which variation can be used by each piece of equipment is important. The default used by many facilities for AES-3 audio is stereo, 48kHz sampling at 20 bits. This default is accommodated by most production equipment, and although different sampling rates of 32- and 44.1kHz with data resolution of 16 or 24 bits can coexist, it is good practice to keep to one interchange format. If planning for 24 bits in the future, make sure that all equipment being purchased is 24-bit capable. All AES-3 variations can be embedded into digital video and deciding when to use embedding is usually a matter of economics and facility functionality.

Conversion

Converting from analog to digital has many advantages in data storage, transmission and processing. Probably the most important factor is that the signal is not changed as it passes from one piece of hardware to another. Therefore, it is important that the levels are set correctly at the point of conversion from analog to digital. These levels will then be maintained throughout the system of the standard cabling systems: balanced XLR connectors or unbalanced 75Ω BNCs. There is no real benefit in using one cabling system over the other, although using coax with BNCs is often preferred. BNCs take up less connector space (important for large routing switches) and unbalanced does not require the expense of transformers for coupling. When transporting data, either system will work and the choice of cabling becomes one of cost, space, convenience and distance to be covered.

AES-3 features

Besides the advantages of using digital signals, the AES-3 standard allows for easy routing and distribution of stereo (or two mono) signals. Additional paths can be used to route multichannel signals for multichannel operations such as a second language or the use of three AES-3 paths for transporting uncompressed Dolby Digital 5.1. Audio synchronization (audio to audio and audio to video) and any requirement to separate or process the audio channels individually (left, right, invert, mixing, etc.) must also be considered. Audio-to-audio synchronization is usually accomplished using a common reference, such as AES-3 silent signal. This synchronizes the Z-flag reference to the start of the 192-frame block structure. Not all equipment locks to an AES-3 refer-

There is no real benefit in using one cabling system over the other.
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Switching between video streams with embedded audio, however, also has problems.

that combines or switches between synchronous, but not block aligned, AES-3 streams should be able to handle this situation. It is also preferable for an audio mixer, for example, to accept and process non-synchronous streams without problems. Output streams should then be re-encoded as AES-3 compliant streams at the mixer output synchronous with the AES-3 reference.

Synchronous audio is also important when live switching between different audio signals is needed, especially if this is in combination with a video vertical interval (VI) switch. The relationship between the AES-3 frame sequence to video (525/60) covers five video frames using 8008 audio frames before repeating. This relationship, however, is not related to any particular video frame or the audio 192-frame blocks. Therefore, it almost impossible to know where the sequence is when a switch is required. Switching between digital audio streams should include a fade down and fade up of the audio at the switch point to prevent illegal audio level changes from being introduced into the audio datastream. Switching between audio datastreams requires the data to be decoded and the channel and other status bits rebuilt to maintain the 192-frame block structure in the output.

Non-synchronous audio often requires a hard switch to be used instead of a mix, and the data blocks at the switch point will be corrupted. Preserving the data structure is important to prevent unknown effects from being introduced by equipment that does not adequately process a non-controlling datastream. When a switch occurs between two non-aligned audio block sequences, both the out of point of the old audio block mute the audio stream when a non-conforming block structure is received so as not to introduce digital pops or clicks into the signal path. The response to a discontinuity, however, may vary greatly between products.

![Diagram of Hybrid Facility](image)

**Figure 2. Hybrid facility showing combination of analog, AES-3 and embedded audio formats.**

Embedded audio

There are many cases when using embedded audio should be considered. These include routing audio and video over long distances, where up to 16 channels of audio (eight AES-3 streams) can be accommodated within the serial digital video signal, or when many pieces of equipment can accept or produce embedded audio. This can provide a cost saving on ancillary equipment for routing and converting audio separately from video. For instance, commercials played from media file servers can often be output with audio embedded in the video. This can be routed through a video router to master control and then on to the transmitter all within the SD video signal. Processing the audio, if required, can be accomplished within the master control switcher by de-embedding and re-embedding the AES-3 data. This also provides for split video and audio effects as well as final level control and the ability to choose left- or right-only channels as required.

Switching between video streams with embedded audio, however, also has problems. It is impossible to prevent audio block sequence corruption at the switch point without de-embedding the audio and processing it separately. Providing on-air routing is not required, implementing embedded audio can save the cost of audio routing and cabling especially in master control. (See Figure 2.) Embedded audio is usually too costly and would overly complicate operations where separate audio and video processing functions are used, such as in a studio or production suite.

With careful planning, a facility can migrate toward a fully digital facility without large expense and additional conversion costs. If HDTV or media file servers are being added, these often force the issue by determining where to target the use of digital.

Mike Betts is the senior partner of Broadcast Training Partners, Nevada City, CA.
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Today some 62 percent of American households have access to at least one digital television signal. Three years ago no home in America had access to this technology. The digital age has truly revolutionized television broadcasting, bringing about the most significant change since the advent of color television some 45 years ago.

The antennas that transmit this digital bitstream have experienced a similar magnitude of change.

Until late in 1997, analog was still the primary means of television transmission. As a result, the transmission system, including the antenna, could be optimized at those specific frequencies where the majority of energy was present; picture, color carrier and aural carrier. These frequencies represent only a small portion of the full 6MHz bandwidth used by the station. Today, digital broadcasting requires that the full 6MHz bandwidth of the television channel have a linear response throughout the transmission system with minimal VSWR and group delay (transmission system includes transmitter, RF system, transmission line antenna and any associated interconnects). With digital, more bandwidth means more data transmission capability, a key issue in today's information age.
The broadcaster must go through a series of steps to determine what options are available for the implementation of DTV service.

There are a number of hurdles that must be overcome to ensure successful implementation of DTV. In addition to tower capacity and the cost of conversion to DTV, the modulation war, 8VSB vs. COFDM, must be resolved. Whatever the outcome of the latter battle, modulation scheme will not change antenna system design. Antenna systems designed today for digital broadcasting using 8VSB modulation will require no modification should COFDM or both modulation standards be adopted. Also, there are no firm business models in place today that will allow the broadcaster to immediately profit from digital transmission. This issue may be self-resolving in that new means for the transmission of data are always being sought. The medium capable of transmitting the greatest data rate in the most economical manner will be the dominant medium; this may be the future of terrestrial broadcasting.

When designing an antenna system, several criteria must be considered. First, system linearity (otherwise known as output response or frequency response) across the full 6MHz channel must be optimized. This is the gain and phase response vs. frequency across the channel. Whether the antenna is a top mount, a side mount, a pylon or a panel antenna the linearity must be such that this response is maximized. System non-linearity can result in gain variations across the channel in excess of 10dB. This variation in gain will result in an increased bit error rate. Although the receiver may be able to compensate for this, it will result in a reduced carrier-to-noise ratio and a total loss of coverage in the fringe areas. The goal should always be to minimize amplitude and phase distortion in the transmission system while saving the equalizer headroom in the receiver to

The adjacent-channel antenna has its pros and cons.
correct for propagation path defects. Specific causes for this gain variation (poor output response) will be examined further.

Directly related to the output response of an antenna is the beam sway. Beam sway is the term used for the variation in beam tilt across a given channel. End-fed antennas have an inherent tendency to have a beam sway in excess of 0.5 degrees depending on the antenna gain and "phase taper" from slot to slot. The resulting beam tilt is higher than desired at the lower edge of the band and lower than desired at the upper edge of the band. This is due to the fact that pylon antennas are typically designed for a slot spacing of approximately one lambda at the center of the channel. As this spacing varies, a cumulative phase taper will result from slot to slot, creating a variation in beam tilt. At Channel 41 for example, the wavelength is 18.59 inches. If the radiating elements (slots) in the antenna are spaced at one wavelength in the center of the channel (360 degrees, or 0 degrees between elements), at the lower end a 1.7-degree phase taper will result (spacing of the elements is 358.3 degrees versus 360). The opposite phase taper will occur at the upper end of the channel. The result, about 3.4 degrees total phase taper between each layer of the antenna. This is a cumulative taper in that between slots one and two, the phase taper is 3.4 degrees; between slots one and three, it is 6.8 degrees and so on. The higher the antenna gain (more elements or slots), the narrower the main beam and the more significant the resulting beam sway. Also, the associated group delay variation across the channel can approach 20nsec. from the end-fed antenna alone. The only way to totally eliminate beam sway is to center feed the antenna with equal slot characteristics above and below the feed point. Each half of the antenna will have equal and opposite beam sway, thus having a total cancellation effect. This results in an elevation pattern main beam that is extremely stable. Beam sway is one of the most significant contributors to gain variation across a given channel. Also, by center feeding the antenna, the group delay can be reduced to less than 10nsec.

Another critical parameter in the design of a pylon antenna is the antenna "illumination." Illumination refers to the phase and amplitude distribution to each slot of the antenna. The phase distribution is varied in part by changing the slot spacing from layer to layer. The amplitude distribution is varied in part by changing the coupler diameter within the antenna. To get the optimum frequency response out of a DTV antenna, a tapered illumination should be used with the power distributed at higher levels near the center or feed point of the antenna and reducing as you approach the end slots. A tapered illumination will yield a very stable elevation pattern throughout the null structure. The tapered illumination combined with a true center feed will generate a superior frequency response across the full channel in both the main beam and throughout the viewing area.

The DTV allocation table has 357 adjacent channel allocations, 195 N+1 and 162 N-1. N+1 refers to an allocation where the DTV is the NTSC
channel plus one (e.g., 17NTSC/18DTV). These allocations offer a unique opportunity and challenge to the broadcaster. If tower loading is an issue, there is the possibility of transmitting both the NTSC and DTV signals from a common antenna. However, until recently combiner technology was only available for the N-1 applications. This is no longer the case.

As with all possible configurations, the adjacent channel antenna has its pros and cons. On the plus side is the load placed on the tower. In many cases, both services can go on the tower with little or no tower modification. Also, when an adjacent channel antenna is installed, an immediate improvement to NTSC service should be realized. With the adjacent channel antenna, the elevation and azimuth patterns are nearly identical for both channels. This will ensure that a uniform signal is received throughout the viewing area over both channels. On the downside, there are power limitations to the adjacent channel antenna. With current technology it is unlikely that a 5MW NTSC and 1MW DTV (maximized) could operate out of a common antenna because of the power handling. Also, if there is a problem with the antenna or the associated transmission line run, both the NTSC and DTV services would be off the air. For those stations with the adjacent channel allocation and sufficient tower capacity, a unique solution would be two adjacent channel antennas co-located. One antenna would be for primary NTSC service and backup DTV service and the second antenna would be for primary DTV service and backup NTSC service. Should either antenna or transmission line run fail, the backup system for both services is in place. This method of redundancy has been used by KSTR-49/DX-48 of Irving, TX.

A panel alternative

An alternative to the pylon antenna is the broadband panel. This is the type of antenna that the majority of the international broadcasters are accustomed to using. International markets have embraced this technology with success because of the need for colocation within a major metropolitan area and the lower transmitter power levels used. In the domestic market, single transmitter power levels can exceed 50kW average and multiple frequency installations can have combined transmitter power levels in excess of 100kW average. The same technology that was acceptable for Europe is not acceptable for the U.S. Major design changes in panel antennas and the associated power division/feeder system have allowed this technology to extend to the domestic market, even at the power levels above.

As mentioned earlier, the same issues that are considered for pylon type antennas must also be considered in the design of a panel antenna. The primary advantage of panel an-
tenna designs is the fact that multiple channels can operate in a common system allowing for a common master-antenna system shared by multiple broadcasters. Also, with a branch feed system the beam sway is minimized due to the fact that the path from the antenna input to the individual panel is nearly identical for all panels. There is no cumulative phase taper as with a pylon antenna and the relative phase to each layer in elevation remains constant as frequency changes keeping the beam sway at a minimum. Custom azimuth and elevation patterns can be generated with the panel antenna by changing the number of panels in elevation, orientation of panels, number of panels around the structure and the phase and amplitude feed to each panel. Custom patterns have been generated in both elevation and azimuth for both the World Trade Center and the Empire State Building in New York City.

When designing an antenna system, the feed to the antenna cannot be neglected, as this is part of the “system response” equation. As mentioned earlier, this response must be linear in that all components in the transmission path must be optimized across the full channel or channels of operation. To get the desired response, the feed should be coaxial transmission line vs. waveguide unless power handling prohibits the use of coaxial line. To minimize this as an issue, transmission line has been designed to handle the high power levels of even the largest master antenna systems. This is a proprietary product known as EHT Line. Although waveguide is a more efficient means of getting a signal from the transmitter to the antenna, the group delay added to the system by such a run must be compensated for at the transmitter. Coaxial transmission line does not have the group delay associated with it (in addition to having a fraction of the wind-area of comparable waveguide).

When choosing the method of DTV implementation, consideration should be given to the channel of operation after the transition period; post 2006. Many VHF broadcasters have been allocated an UHF digital channel at 1MW effective radiated power or ERP (1573 of all DTV allocations are UHF). Based on the current FCC ruling, VHF broadcasters have the option of going back to their VHF channel for digital broadcasting after 2006 (post 2006 all broadcasters will reside within the core spectrum of Channels 2-51 with Channels 52-69 and less than 10 years old? If the answer to both of these questions is yes, than a side-mounted aluminum DTV antenna for the interim period may be the best and most economical option. If plans are to go back to the NTSC frequency and the antenna is old or non-digital compliant (end-fed, simple illumination), a stacked

Antenna systems designed today will require no modification should COFDM be adopted.
Thomson TH770s in the Comark IOX Transmitter at WVLW, Louisville. The six tubes used can output 50kW each for a combined power of approximately 300kW. Photo courtesy of Thomson Tubes Electroniques.
A major controversy exists among American TV broadcasters and regulatory bodies. A few years ago, the FCC chose the ATSC system based on 8VSB modulation. Some people in the industry are questioning that choice, claiming that the European system, DVB-T (COFDM modulation), offers real advantages, such as easier reception inside buildings or by mobile devices.

Rather than offering a solution to the controversy, this article discusses the performance of tubes and cavities for the two different types of modulation. Use of the TH 770 IOT for both 8VSB and COFDM operation is examined. The TH 770 IOT from Thomson Tubes Electroniques (TTE) is already used by several manufacturers for their analog and digital transmitters. In analog transmission, it offers output power of 63kW for the picture (peak sync) and 6.3kW aural in combined amplification mode.

**8VSB performance**

The TH 770 is also used as the final stage in 25kW 8VSB transmitters. In an attempt to improve performance, we acquired a modulator/corrector from Thomcast. This device supplies an ATSC signal on any UHF channel, starting from a real baseband bit stream, or a pseudo random bitstream generator.

The output signal is sampled after the final stage and compared to the output signal of the modulator. The transfer curve can be extracted from this measurement, for both phase and amplitude. The corrector then applies to the modulator signal a pre-distortion which is reciprocal to the calculated distortion of
the cascaded amplifiers. The convolution of this pre-distortion and the amplifiers’ distortion should theoretically provide a perfect signal to the antenna. Spectrum analysis is used to assess quality.

Best results are reached by limiting the range of correction well below the peak power level. High power values are scarce and have only a very limited effect on intermodulation. This means that tubes should not be ranked in terms of peak power capability, but rather according to average power output.

These results are clearly summarized in Figure 1, which shows both the power meter and the spectrum analyzer. In addition, the shoulder levels were measured with a vector signal analyzer, by integrating the power spectral density over a 5MHz band in the middle of the channel, and over 500kHz along the edges of the channel. We used a flat top input window to ensure amplitude accuracy. The shoulders are shown in Figures 2 and 3.

At an average power of 30kW, the left shoulder = level in the middle – 10dB = left side level; i.e., left shoulder = -12.478dB – 10dB + 58.115dB = 35.6dB. The 10dB factor compensates for the integration width of 5MHz in band, 500kHz out of band. Also at 30kW average power, the right shoulder = -12.478dB – 10dB + 57.803dB = 35.3dB.

**COFDM performance**

The modulator can also output a COFDM signal, at 7- or 8MHz bandwidth, with 8000 carriers 64QAM modulated. We repeated the previous experiment, under the same operating conditions, and with the same channel 50 (706MHz central frequency in Europe), changing only the modulation scheme. We attained average power of 15kW, with slightly better intermodulation (36.2dB on the left shoulder and 36.4dB on the right shoulder; see Figures 4 and 5). This significant difference in average power is due to the difference in peak factor: 7dB for 8VSB versus 11dB for COFDM.

As for the 8VSB tests, we found that optimum results were obtained by
not attempting to correct the transfer curve up to the peak power. Under the same conditions, with comparable intermodulation, the TH 770 IOT offers twice as much average power with 8VSB as with COFDM (8000/64QAM). These good results were achieved using a clever setup.

**Test setup**

In the output circuit, saturation plays a role in determining performance, whether in terms of voltage saturation (i.e. the slower electrons fly back in the interaction gap) or current saturation (i.e. the peak current is not limited by space charge, but by the Richardson-Dushman law). Increasing the high voltage has an effect on both (even on current saturation which does not occur uniformly over the cathode). All of our measurements used only 34kV of beam voltage. The correct load impedance must be chosen to prevent voltage saturation. The S21 bandwidth of the final amplifier stage is a good indicator for the correct setting.

Figure 6 shows the output bandwidth for an NTSC analog TV channel (8.8MHz 1dB below the peak). It was increased to 10.5MHz, 1dB below peak by changing the coupling between the two output cavities. A patented system on the TH 18770 cavity ensures that the bandwidth remains the same no matter what channel is used.

**Input circuit:**
The spectrum of the corrected 8VSB signal is wider than the non-corrected 6MHz signal. In other words, the correction signal has spectral components outside the interval (fc - 3MHz; fc + 3MHz). These components must not be reflected by the IOT input circuit. Figure 7 shows the reflected (S11) bandwidth for NTSC. It has been expanded using a double slug tuner as shown in Figure 8.

**Driver:**
Correction is not meant for the final high power amplifier stage only, but for the whole cascade of amplifiers. For all of our experiments, we used a slightly oversized bipolar solid-state preamplifier from Itelco, rated at 800W (analog service).

**Video response:** Flat video response is needed for satisfactory intermodulation levels. This also applies to DTV, even though the term video response does not seem appropriate for digital modulation.

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We found that optimum results were obtained by not attempting to correct the transfer curve up to the peak power.

All resonances under 8MHz in the circuit formed by the cavity, the tube, the cables and the supplies have to be removed. For these applications, the TH 18770 has clear advantages. First, a capacitive short circuit for frequencies under 10MHz has been installed close to the tube, between the cathode and the grid. Secondly, both cathode and grid are connected to ground by a high-value capacitor, which is also used as a blocking capacitor for the beam voltage. This type of layout facilitates a flat video response.

Based on our findings, several conclusions can be drawn: First, COFDM is a more difficult signal to amplify than 8VSB. At a given average output power, a COFDM system requires twice as many tubes. Because IOTs and Diacrodos are used for high-power applications, our experiments on the TH 770 IOT could well apply in general. Second, peak power is definitely not the sole factor in component choice. Many other factors must be considered, such as the tube’s video response, input and output bandwidth and intrinsic linearity. In the final analysis, only comprehensive measurements such as those described here can provide an understanding of power component performance.

Michel Langlois is R&D manager, Digital UHF TV Products, Thomson Tubes Electroniques, France.
Datacasting:

Is it legal?

by Mitchell Lazarus

A digital television (DTV) channel has a lot of raw capacity. The FCC requires one free video signal of NTSC quality or better, which amounts to only about 20 percent of the potential payload. The rest can be used to provide any lawful service the licensee chooses, including the transport of data for pay—sometimes called datacasting when carried over broadcast facilities. A particularly promising subcategory of datacasting is the use of excess DTV capacity to provide access to the Internet.

A DTV channel carries 19.4 million bits of data per second. A single NTSC-grade video signal occupies only about 18 percent of that capacity, about 3.5 Mb/s, so a DTV channel can be used to carry about five NTSC-quality video subchannels. Alternatively, it can carry one high-definition video service, which needs a lot more data, or it can carry the FCC's minimum of one NTSC-grade video service and use the almost 16 Mb/s left over for other services. That 16 Mb/s is enough to download an entire edition of a local newspaper in less than two seconds.

The FCC treats anything on a TV channel other than a free video signal as "ancillary service." The licensee may charge for ancillary services.

Special cases:
1. The FCC requires a DTV station to carry at least one free video signal at NTSC resolution or better on or after these dates:
   - All major-network-affiliated stations in the top 30 markets now;
   - All remaining commercial stations by May 1, 2002; and
   - All non-commercial stations by May 1, 2003.

   This free video service must air during the same time periods as the licensee's analog signal, although the programming need not be the same as on the analog channel.

2. After the applicable date listed above, a DTV station that carries its one free video signal can use the rest of its capacity for ancillary services. Before the applicable date, the station can carry ancillary services regardless of other programming.

3. If the only signal the station carries is high-definition video, then that signal must be free, and there is no ancillary service.

4. If a station transmits more than one free video signal, all are subject to FCC broadcast regulation and none of them is ancillary.

5. Pay video services are ancillary and can only be provided in addition to the required free service.

In practice, any lawful service can be offered via DTV on an ancillary basis. Ancillary services may, but need not, relate to the video program then being broadcast. The FCC's examples of ancillary services include sports information, computer software, telephone directories, stock market updates, interactive educational and other services, data transmission of any kind, and even audio materials. Mobile wireless services such as paging also qualify as ancillary.

Ancillary service is not subject to
broadcast regulation. But if an ancillary service is analogous to some other FCC-regulated service, then it is subject to the same regulations as that other service. For example, a DTV licensee that offers paging as an ancillary service would be subject to the FCC paging rules.

Delivering ancillary services via DTV requires appropriate equipment at both ends of the communication. The broadcaster needs equipment to acquire the ancillary data and merge it into the MPEG bitstream for transmission. Each end user needs circuitry to receive, select and demodulate the channel, plus the means to separate out and use the ancillary data. Analysts expect future DTV receivers and set-top converters to have data ports that will simplify these functions.

Common carrier issues

Providers of data transport are generally considered to be providing telecommunications services. Some telecommunications providers are deemed to be “common carriers,” a status that imposes special legal responsibilities. A common carrier must provide service to all that request it (up to the limit of capacity), may not discriminate unreasonably among customers, and is subject to complaint proceedings at the FCC. A non-common carrier, in contrast, is free to negotiate any terms with any customers it pleases. Most DTV stations will probably prefer to avoid common carrier status.

A DTV station that carries data on an ancillary basis risks being treated as a common carrier if it meets all of these conditions:

- It offers service for a fee;
- It transmits information of the user’s choosing;
- It transmits and receives the user’s information without change;
- It transmits between or among points specified by the user; and,
- It offers service directly to the public.

A licensee engaged in datacasting is likely to meet the first four tests above. In that case, its common carrier status will turn on the fifth test, whether it provides service to the public. The licensee can minimize the likelihood of being considered a common carrier if it sells services to other companies, rather than directly to consumers; if it markets its services in trade publications, rather than consumer media; and if it sells service under contracts that run at least a year, rather than monthly.

Fees

A DTV licensee that provides ancillary datacasting services is potentially subject to several fees levied by the FCC.

**DTV ancillary fee:** DTV ancillary services may compete with more traditional radio-based services, some of which must buy spectrum at auction. Congress feared that DTV’s free spectrum would give it an unfair competitive advantage, and so authorized the FCC to impose a special DTV ancillary fee to help level the playing field. The FCC set that fee at 5 percent of DTV revenues received from transmitting other entities’ data. Licensees are required to file a return and make payment each Dec. 1 for the year ending on the previous Sept. 30.

**Universal Service Fund and TRS fees:** A DTV licensee that derives revenue from data transport may be subject to two additional fees, each calculated as a percentage of telecommunications revenues. One is the Universal Service Fund fee, which subsidizes service in high cost areas and to low-income consumers, schools, libraries, and certain health care providers. Presently at about five percent, it fluctuates quarterly. The other is the Telecommunications Relay Service fee, which supports special telephone services for hearing- and speech-impaired users. Adjusted annually, it has always been a small fraction of one percent. Both fees are subject to exemptions and have complex rules for calculating the base amounts on which the percentages are levied. How these rules will apply in the DTV context is not yet fully clear.

In addition, a DTV licensee will ultimately pay a “regulatory fee” to the FCC. Today the regulatory fee imposed on its associated NTSC facility covers the station, but the FCC will doubtless impose a separate fee on DTV stations once licenses have relinquished their analog frequencies. So far there is no indication the fee will depend on whether the station offers ancillary services.

**Internet access**

One potential business for DTV ancillary services is the provision of Internet access: hooking up homes and businesses to the Internet.

Today most residential and small-business users reach the Internet by dialing over an ordinary telephone line to an Internet service provider (ISP), which connects the user to the Internet backbone. Besides providing the all-important connection, most ISPs also supply end-user software, display a “portal screen” that links to popular sites, provide storage for the user’s webpages, and offer technical support as needed. Most ISPs also store, or “cache,” popular sites for faster access by customers. Some offer additional Internet-related services such as webpage design and e-commerce support.

An ordinary telephone line provides only relatively slow Internet service. Given a choice, users generally prefer broadband (high-speed) access. A broadband connection fills up the screen more quickly, downloads large files faster, and can play video and high-quality audio in real time. Two main forms of broadband access are presently available. The first, digital subscriber line (DSL), is a high-speed service that runs over ordinary telephone lines. It is available only to certain subscribers, most of them in densely populated areas. The second option is cable modems. They are also limited to certain areas, and leave many businesses underserved. In addition, many cable companies require the customer to subscribe to a cable-affiliated ISP that may not provide the full range of Internet services. Other emerging broadband options

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**16Mb/s is enough to download an entire local newspaper in less than two seconds.**
include microwave radio and unlicensed “spread spectrum” radio, but these are not yet widely available. Internet delivery by satellite also may become feasible in the near future.

DTV is an alternative means of delivering broadband Internet service. Unlike DSL and cable, which require specific physical connections, DTV Internet is available to customers anywhere in the DTV station’s coverage area.

A DTV station’s ancillary capacity is the equivalent of almost 300 conventional telephone lines (at 56kb/s), or about 10 DSL lines. However, all users must share this capacity. If 300 customers attempt to download at the same instant, each will receive data only at phone-line speeds. In practice, though, this limitation is less severe than it may seem. Only users who are transferring data at a given moment impinge on the capacity available to others. Customers who are reading the screen, printing data, or typing commands have no effect on others’ download speeds. Nevertheless, the average speed available to each customer will tend to drop as more customers sign on.

Uplink required: Internet service is two-way. A downlink connection delivers Internet material to the user, while a return uplink channel communicates the user’s keypresses, mouse clicks and outgoing messages back to the ISP. DTV can provide only a downlink, although at high speed. Fortunately, most users need only a low-speed uplink channel. An ordinary telephone connection usually suffices for the uplink unless the customer is one of those few who must transfer large amounts of data. Another uplink option is the wireless 218-219MHz service formerly called the Interactive Video and Data Service (IVDS), and originally intended as a return link from viewers to television stations. Other radio options may be available in particular areas.

**Internet roles for a DTV licensee**

A DTV licensee interested in providing Internet access can take either of two roles.

Carrier only: The licensee can act solely as a carrier to deliver data from an ISP to end users. The DTV licensee would typically contract with the ISP, which in turn markets the service to end users as part of an ISP-provided package. The DTV licensee collects a fee for carriage from the ISP. The service can be priced in the aggregate, monthly per user, by the amount of data carried, or by any other agreed-on formula.

Carrier and ISP: Alternatively, a DTV licensee can itself function as an ISP. In addition to delivering data to the end user, it would receive the end user’s uplink signals, interconnect the end user with the Internet backbone, and perform the various ISP support functions. Residential end users typically pay their ISPs a monthly fee in the $25 to $50 range for broadband service. In addition, some ISPs collect fees from unaffiliated commercial websites in exchange for prominent listings on the ISP’s portal page.

Common carrier issues: We noted the disadvantages of common carrier treatment above. A DTV licensee can probably avoid being classed as a common carrier if it acts only as a carrier, and not also as an ISP. The licensee can then market its service to ISPs, instead of directly to the public, and sell service for a minimum period of one year. A licensee that also wishes to function as an ISP runs a greater risk of common carrier treatment, as it would probably wish to market directly to the public and offer service by the month. The licensee may nonetheless be able to avoid common carrier status by setting up its ISP as a separate corporation and selling the communications service to the ISP on a long-term basis, rather than providing monthly access service directly to the public. Caution: The legality of this approach has not yet been tested.

**Equipment for Internet access**

Each DTV station offering Internet access will need equipment capable of receiving customer-bound data from the ISP over standard data lines, adding customer address information and encryption, and merging the data into the MPEG-format bitstream for DTV transmission. A DTV licensee that also acts as an ISP will need the servers, storage and transmission facilities, and other equipment needed to maintain a connection with Internet backbone facilities.

Each customer will need equipment (a “DTV modem”) capable of splitting off Internet data from the DTV signal, identifying data addressed to that customer, decrypting it, and converting it to a form compatible with the desktop computer. The plug-in computer cards with DTV tuners available now may not be able to identify and decrypt ancillary data correctly.

As noted above, data ports on future DTV receivers and set-top converters should eventually simplify connection for the end user.

Privacy is a special concern in shared systems, like cable and DTV, in which each user’s equipment monitors all the bitstreams directed to all users. Such systems require close attention to addressing, so that each user’s equipment recognizes only the communications directed to it. Equally important, all transmission on the system must be carefully encrypted to protect each individual user from both inadvertent and intentional interception.

**Going forward**

The excess capacity available on a DTV channel makes it possible for the licensee to offer a range of telecommunications services on an ancillary basis. One especially promising option is Internet access. The timing is right: The demand for broadband Internet access is outrunning available delivery systems, such as DSL and cable, just when DTV stations are going on the air. Providing a link to the Internet opens an opportunity for DTV licensees to broaden their service beyond the traditional viewing audience to people who have forsaken TV screens for computers.

Mitchell Lazarus is an attorney with Fletcher, Heald & Hildreth, P.C. He can be reached at 703-812-0440, mlazarus@alum.mit.edu.
HDTV won't replace all other formats anytime soon. That's why the PESA Alliance Master Control Switcher makes so much sense. The Alliance is designed for: 1) full-time SDTV; 2) full-time HDTV; or 3) mixed SDTV and HDTV broadcasting. Multi-format technology allows SDTV systems to be upgraded to HDTV, preserving your investment. The PESA Alliance also supports multi-channel capability, so you're ready to handle any programming strategy.

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Choosing the right routing switcher fabric and control system is one of the most important decisions a director of engineering or chief engineer must make when constructing or upgrading a television facility. This article explores the various technologies and topologies available today, and in the near future, to help guide decision-makers toward the right choices.
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There are two basic topologies in common use today:

- A central equipment pool. Expensive pool resources are allocated as needed to the various functional areas in the facility, i.e., on-air broadcast, production, news, etc.
- Distributed resources or islands dedicated to the specific functions.

Real facilities usually have a combination of the two topologies. Most systems have evolved through a mix of factors: market forces, facility history, individual personalities and corporate culture. The choice of a new routing switcher fabric and control system will also be governed by these factors.

**Fabrics and control systems**

Routing switchers were basically considered patch panel replacements. The control systems were very basic, consisting of simple control panels. Typically, the most sophisticated feature was the video/audio split.

Today's control systems, driven by user creativity, have evolved into highly flexible and therefore complex systems.

With the advent of digital video and the development of common ASICs, the hardware fabric performance is fairly uniform among reputable vendors. The control system is now the dominant factor that should drive the choice in choosing a new facility infrastructure.

The most basic topology for routing switchers is the X/Y matrix, with X inputs by Y outputs. It is easy to understand and control. It is ideally suited for the central equipment pool topology. Its main disadvantage is that the price tag grows with the number of inputs times outputs.

The enormous cost of large X/Y matrices led to the development of control system algorithms that allow for the reduction of the number of crosspoints for larger fabrics. The algorithms were originally developed by the telephone industry and subsequently modified for broadcast use. There are three common techniques, each with its unique set of advantages and disadvantages. They are multistage cross-point arrays, path-finding or distributed fabric arrays, and time division multiplexing (TDM) virtual arrays.

**Multistage systems:** The most common implementation is a three-stage topology. This topology consists of small X/M input matrix blocks, moderately sized M/N middle or intermediate matrix blocks and small N/Y output matrix blocks.

Multistage topology can yield significant cost reduction for large fabrics. There are several three-stage routing switchers operating today at facilities such as ZDF in Germany, BT in London and USA Networks in Los Angeles.

One of the main concerns with three-stage architecture is its ability to route connections through the fabric. For the telephone company, this was not a big issue—they simply give you a busy signal or an all circuits in use recording. For broadcasters, this is unacceptable, so sizing and control algorithms were developed to reduce the possibility of a block to extremely low probability. This need not be a major concern when considering a multistage fabric topology from an experienced multistage vendor.

One drawback of multistage topology is a slight degradation of performance. Each connection goes through the underlying X/Y blocks three or more times. This was a major concern for traditional analog audio and video fabrics, but is less of a concern for today's digital fabrics.

**Path-finding fabrics:** These are a physical distribution of small X/Y matrices, interconnected by trunk or tie lines. This topology can realize enormous cost savings in a facility where the island topology is dominant. While yielding the greatest savings in hardware, it is the most complex topology to control and requires careful planning before deployment.

One unique benefit of path-finding is the ability to complete format conversions within the switch fabric. This is particularly important in today’s transitional market, from analog to digital audio and video, or uncompressed vs. compressed digital audio and video. A small number of format converters can be integrated into the fabric and transparently routed through, based on source and destination format requirements. Modern control systems should have this capability.

Just as in the multistage, be sure to consider purchasing this type of system from an experienced vendor. Another topic that is closely related to the idea of pathfinding and tie-line management is the growing requirement to provide a seamless control system for routing switchers located in separate facilities. In choosing a control system, it is important to look for the ability to use standard local and wide area networking (LAN/WAN) architectures, including the Internet, to provide extended control functionality over long distances or local control over a LAN.

**Time division multiplex (TDM) fabrics:** While not yet economically feasible for full-bandwidth digital video transport, TDM fabrics are an attractive option for AES digital audio routing fabrics and possibly compressed video. The cost of designing and building this type of fabric continues to drop rapidly due to advances in ASIC technology and high-speed serial transports on copper and fiber. TDM can be used to implement a large virtual X/Y fabric in a central frame or a distributed manner.

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**Figure 1.** A three-stage matrix uses an intermediate set of crosspoints to provide connections from N inputs to M outputs using fewer crosspoints than an X/Y matrix.
Eclipse: Connect With Our Most Effective, Compact, Expandable Design.

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ed fabric using add-drop mux/demux boxes interconnected by high-speed serial copper or fiber trunks.

There are always tradeoffs that need to be made, and this option is no exception. The virtual fabric created in a TDM router is based on uniform time slots. Each input or output corresponds to a specific time slot assignment for its sample transport. This normally implies a synchronous system architecture (there are exceptions) extending beyond the fabric and throughout the facility. If the system is not frequency locked, then the fabric must perform sample rate conversions, which inherently modify or distort the signal. In fact, the worst case distortion occurs for nearly identical input to output sample rates. Proper digital audio facility design is akin to system timing for NTSC or PAL analog video. Keep in mind that you will have to do some sample rate conversion due to the multiplicity of rates you will encounter, i.e., 32, 44.1, 48, 96, 192kHz, vari-speed or when encountering 29.97 vs. 30Hz frame rates.

Switching Dolby E will require a synchronous facility so that switching occurs within the time fences defined by Dolby E, based on video frames.

Make sure you understand your requirements and the vendor offerings before making a purchase decision for virtual or TDM routing fabrics. There are products available protocol layers have motivated this. Gigabit Ethernet, IEEE-1394, USB physical layers and IP and ATM protocol layers fit loosely into this arena.

The development of MPEG-2, -4 and -7 video compression and AC-3, MP3, and Dolby E for audio compression have added a whole new range of possibilities for distribution of video, audio and now metadata within facilities, using the packet-based fabric or network topologies. These technologies can be very useful for the distribution of non-real-time video as files or lower bit-rate, real-time transport for lower-quality requirements, i.e., desktop monitoring, Internet video streaming, or other imaginative applications like remote site monitoring. Keep in mind that high-quality, real-time signal transport will still require full-bandwidth signal paths.

Web-based control and monitoring of switching fabrics and distribution equipment is also starting to show up on the market. This is an easily leveraged technology available from the PC/workstation market, so look for it to become commonplace.

A designer of facility infrastructures needs to consider these technologies as viable players in the design. Beware of becoming overwhelmed with the possibilities. Make sure you understand the tradeoffs in quality and content-delivery latency before jumping in.

Asynchronous transfer mode (ATM) fabric: Depending on the path parameters, ATM fabrics, while being cell-based, do have some nice characteristics that can be defined by the service requester. An ATM cell is analogous to an IP packet with a fixed 53-byte length, five bytes for the header and 48 bytes for the payload. ATM can guarantee quality of service (QOS) beyond the facility walls, and even internationally. ATM is independent of the physical layer. It is a method of transport within the synchronous digital hierarchy (SDH) and SONET. This author considers ATM a step above IP transport and believes you will see IP transported by ATM or ATM transported over IP. Therefore, when considering your networked infrastructure, look at ATM as a possibility. Look to ATM for interfacility and inter-city transport of lightly compressed video and audio in the future, using the public networks.

Optical fabrics and wavelength division multiplexing (WDM): There have been several demonstrations of

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It is important to look for the ability to use standard LAN/WAN architectures, including the Internet, which offer a good compromise of synchronous vs. asynchronous features and control system flexibility.

Packet, cell and/or network-based fabrics: While packet-based switching has been around quite a while, it has only recently started to enter the broadcast infrastructure. Universal standardization of protocols, the Internet, inexpensive computers, and the availability of inexpensive networking components implementing the physical and

Figure 2. Path finding topologies can include format conversion within the fabric but require sophisticated control systems.
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optical switch fabrics in the past two decades. One would think that by now optical interconnect and optical switching would have replaced broadcast facility infrastructure. Why hasn’t this happened? There is one fundamental reason: pure economics. While the technology exists, it is still far too expensive compared to traditional methods. Electrical/copper interfaces, even at 1.485 Gbps, are much cheaper than their optical counterparts. As the telecommunications industry progresses toward low-cost electrical/optical conversion, transport and switching, the television industry will leverage the technology. Don’t hold your breath, full-bandwidth video transport is probably a decade away.

Great debates and hazard warnings

Beware that the major routing and control system vendors are fierce competitors. Some of them are actively engaged in the propagation of FUD (fear, uncertainty, and doubt) regarding their competitors’ products. This makes your job more difficult as you have to sort through the FUD. The section explains what you may encounter.

Non-reclocked vs. reclocked serial digital video: In the early days of serial digital video distribution, a great debate raged over non-reclocked vs. reclocked outputs. Today there are hundreds of thousands of installed non-reclocked signal paths, which operate without any problems. Non-reclocked paths work for three reasons:

• Good intrinsic signal fidelity in the fabric.
• The path normally exists from a processing device that generates a pristine serial output, to a processing device that subsequently de-serializes the signal, generally with a receiver that has good input jitter tolerance vs. frequency.
• A properly designed serial digital receiver/de-formatter has a much wider input jitter tolerance (IJT) transfer characteristic than an intermediate reclocker. The reason reclocking seems to be a good thing is that it does reduce jitter. This is normally accomplished by restricting the reclockers’ PLL bandwidth. For a receiver/deformatter, however, one wants to maximize PLL bandwidth so as to maximize the receivers’ jitter tracking range with respect to frequency. The PLL bandwidth of the reclocker placed in a router output is at best a compromise between conflicting requirements. It is entirely conceivable that a poor-quality input source could become errored in the router reclocker, but be accepted by the subsequent device’s receiver/de-formatter without error due to its wider PLL bandwidth, i.e. better IJT, had the reclocker not been present.

A properly designed reclocking device must, by definition, have two PLL’s and an elastic buffer between the wide-bandwidth PLL receiver side and the narrow-bandwidth PLL transmission side. There are no single chip ASIC reclocker ICs currently available that provide this functionality, either for SDTV or HDTV. Therefore, you may actually be better off without reclocking in your routing fabric for point-to-point and point-to-multipoint paths. See SMPTE Engineering Guideline EG33, for a better understanding of this subject.

The requirements for HDTV fabric design obviate the need for reclocking when SDTV is passed through the HDTV fabric. If you insist on SDTV reclocking in an HDTV product, you are going to pay for something totally unnecessary. The SDTV non-reclocked multipass performance of today’s HDTV fabrics approaches that of the present generation of SDTV reclocked products.

At this infancy stage of HDTV SDI deployment, HDTV reclocking should be a user-selectable option. This is because some serializers and receiver/deformatters for HDTV are poorly implemented. The reclocker may actually help you in this case. Virtually all of the major vendors offer reclocking at HDTV rates.

Synchronous AES vs. asynchronous AES: The issue of synchronous vs. asynchronous AES fabrics is more a facility theology issue than a competitive vendor issue. There is a consistent lack of understanding of how to successfully implement digital audio. Digital audio routing is akin to analog video routing and system timing. If you don’t synchronize your digital audio facility properly, you get pops, ticks and clicks at switch points, or all the time if you try to pass an asynchronous signal through a purely synchronous fabric. If you’re a pragmatist, then you’ll be happy with full-time sample rate conversion, but if you’re a purist or perfectionist, then you need to think about

The PLL bandwidth of the reclocker placed in a router output is at best a compromise between conflicting requirements.

Large routing systems can take considerable rack space. Be sure to plan for sufficient rack space and cooling for the system chosen.
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Deterministic vs. non-deterministic control: Deterministic control systems are those that have a guaranteed latency or delay between the time that a command is initiated and the time that the command is physically executed. For manual push button control, deterministic response is not important because the response of the control system is usually faster than human response time. It is most important when controlling multiple devices that need to be in synchronism, as is the case with legacy linear editing systems and perhaps frame-accurate automation systems.

Most of the modern control systems are based on Ethernet backbones, which are inherently non-deterministic. If the amount of traffic is kept low on the backbone, then there is a reasonable chance that commands will arrive within acceptable time frames. This is why the control system vendors want the control backbone isolated from your corporate LAN, using bridges and routers.

Once you claim Ethernet then you're also saying non-deterministic. The vendors can use time stamping and command queuing (event stacks) to minimize the effects of non-determinism, but there is always a probability that a command may not be delivered when expected.

Real-time vs. non-real-time & full bandwidth vs. compressed

The explosive growth of the Internet and inexpensive, powerful, PC workstations in the past decade is radically changing the way we do things. Editing and graphics creation using workstations and LAN technology is common. This makes it difficult to determine how much full-bandwidth fabric vs. how much compressed, and/or non-real-time fabric is needed in a facility. The full-bandwidth fabric is usually quite expensive, while LANs, SANs, and VLANs are quite inexpensive, even for the Gigabit versions. Today, on one extreme there are those that predict the complete disappearance of the traditional full-bandwidth fabrics in the next five years vs. those who insist that LANs, etc. just won't fulfill their distribution needs. It is already apparent that the industry is in transition toward the use of non-real-time and compressed material transfer, but at the same time, size and sales of full-bandwidth fabrics is actually increasing. It appears that full-bandwidth fabrics are here to stay for the foreseeable future.

Making the right choice

Examine your present and future requirements, based on:

- Existing infrastructure – what are its limitations and strengths? Build on what works, change what doesn't. Can the new control system work with existing fabrics you may want to keep?
- Future expansion needs – how long do you plan to keep the new or upgraded infrastructure? Ten years is not unreasonable for the switching fabric and control system. Plan for expansion capability both in the actual fabric and the control system.
- Emerging technologies – how can they be applied to reduce cost or enhance capability? What are the market forces driving their emergence? Are they realistic or faddish?

What can you afford?

Prioritize your requirements. You will most likely need to compromise some of them based on the available product offerings. It is unlikely that one vendor will meet every one of your requirements.

Research the available product offerings and the companies behind them that fit your requirements.

How well does the product fit the requirements? Utilize the free expertise of the vendor as a solution provider in clarifying the product vs. requirements match. They may have acceptable workarounds that you can live with, or better yet, a better way than yours to accomplish what you want to do. Let them know what your vision is. Usually, they have seen a much broader range of applications and solutions than you have. Observe how well the company works with you in this process.

Is it likely the vendor will still be around to support your future expansion needs? How well do they support their legacy and current products? Look at their track record. Actively investigate several user references.

Does the product comply with industry standards and regulatory requirements, such as SMPTE, UL, FCC, and CE? Ask for proof of compliance/performance information if you have any doubts. This is important, because the end user, not the vendor, is responsible for compliance to some of the regulatory standards.

Consider cost of ownership: product reliability, facility real estate, power consumption, warranty and/or maintenance contract options. How much will it cost to expand the system in the future? Be aware of the size breakpoints where input distribution and/or output combiners become necessary. These will greatly affect the cost of your system. Brand X may have the lowest price for today's need, but there may be a real shock later when you want to expand your system, because of the added distribution amplifier and/or combiner costs.

Document your requirements so that your selected vendors can bid on them. Pick your top two or three vendors and seek competitive quotes from each one.

You may need to recycle through the process for the best fit of your objectives/requirements vs. your budget.

Make your purchase decision with confidence, knowing you've done your homework.

Making the right choices in your facility infrastructure is vital to your business and personal success. The worst mistake you can make is rushing into a purchase decision without understanding what you really want to accomplish. Understanding and applying the available technology choices can seem overwhelming, but is manageable and rewarding if the time is wisely invested. Use whatever resources are available to you, especially free resources from vendors you are considering purchases from. Once you have done your homework, you should be able to make your purchase decisions with confidence.

Barry Albright is a member of the technical staff for Philips Broadcast, Media Networking and Control group, Salt Lake City, Utah.
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Election Systems

BY MATTHEW STRAEB

Live election-night programming represents an opportunity to increase viewership, particularly if the returns are reported in a compelling manner. But like the Olympics, it is an opportunity that comes along only once every couple of years on average — such that networks and stations need to weigh carefully the benefits of an investment in special sets and graphics that will be used for one night and then retired. With the costs of conventional sets constantly on the rise, it is not surprising that a growing number of broadcasters in the U.S. and abroad are turning to virtual sets as a way to create visually striking election night coverage within the confines of a reasonable budget. Part of the attraction is the ability to situate newscasters in a novel, imaginative virtual environment. Even more important, virtual sets are being used to help communicate election statistics more effectively, turning the numbers into an integral, eye-catching part of the setting.

Real-time updates and total automation

Although virtual sets can and are used for nearly any type of TV programming, what makes them especially attractive for election coverage is that the raw data of election results can be directly imported and automatically converted to 3D objects that materialize into the same virtual space occupied by the program hosts. To make this happen within the context of a live broadcast requires a solution in which returns from Voter News Services and other online data sources can be fed into the system and then dropped automati-
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Automating the import of election data and transforming that data into graphical video elements is a capability offered by a number of graphics and character generator suppliers. Such automation requires template pages to be created in advance with pre-defined field styles and positions for subsequent completion by a remote control protocol. That is, the graphics product must be programmed to recognize and read the particular election data. For the most part, election data is supplied as simple ASCII files which the graphics products have been programmed to read and build into animated 3D images. Today's products are extremely sophisticated, and with advance planning and setup, in addition to the bar graphs and/or charts that are rendered, the products can automatically import head shots of the candidates, state maps, and other relevant graphics from a video library. This kind of complex setup obviously calls for sophisticated templates, thought out well in advance, and able to handle multiple changes according to the data feed.

Combining the automated 3D election results with virtual set technology can be accomplished in a couple of different ways. The most straightforward solution is to integrate on-air graphics capability with the virtual set itself, a capability provided by the leading virtual set suppliers. Using these systems, the 3D graphics for election returns are created as part of the set design and expressed as icons, bar charts, pie charts or other representations that are updated automatically when called to air.

Alternatively, a stand-alone on-air graphics system can be used downstream to create graphics and receive updated information from the wire services, which are then switched to a virtual set system. Because virtual set gear is widely available for hire, the first alternative will appeal to stations that may not have invested in any conventional set in virtually any outdoor or indoor environment. Because camera information, and information about the panel's position and orientation, is extracted from the video feed itself using pattern recognition, handheld cameras can be used freely and even the panel itself can be mobile or handheld. Knowing the panel's exact position and orientation, the system maps any desired secondary video signal (1D or analog) on to the particular panel in real time, transforming it into a virtual video screen. Graphic stills or animated election data charts, converted to a video signal, may be used as the video screen source. As a result, virtual elements can be placed in the same scene as a reporter reporting live from campaign headquarters or on-site at a local precinct, for example.

Of course, virtual walls and animated graphics based on fast-changing data have numerous applications beyond election night broadcasts. These include sporting events, home shopping channels, and real-time displays of financial information, and others.

Combining traditional and virtual sets

Another alternative for election night coverage is to combine conventional set and virtual set technology in the same scene, which provides a number of the benefits of a virtual environment at less than the cost of a specially designed conventional set for election coverage or even an entry-level virtual set system. In this type of application, one or more "virtual walls" are introduced into a conventional set and are used to display election statistics, candidate images, and remote and satellite video feeds. There are election systems available that use lightweight panels mounted in any conventional set in virtually any indoor or outdoor environment. Because camera information, and information about the panel's position and orientation, is extracted from the video feed itself using pattern recognition, handheld cameras can be used freely and even the panel itself can be mobile or handheld. Knowing the panel's exact position and orientation, the system maps any desired secondary video signal (1D or analog) on to the particular panel in real time, transforming it into a virtual video screen. Graphic stills or animated election data charts, converted to a video signal, may be used as the video screen source. As a result, virtual elements can be placed in the same scene as a reporter reporting live from campaign headquarters or on-site at a local precinct, for example.

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Matthew Straeb is president of Orad, Inc., New York City.
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Vibrint digital news production applications

BY ROLAND BOUCHER

The broadcast industry has finally reached the point where technology purchasers are no longer at the mercy of manufacturers who sell expensive and unnecessarily complicated proprietary solutions. More powerful computer solutions built on open, off-the-shelf and standards-based technologies are now available.

Broadcast technology evolution

Broadcast news has found it difficult to balance cost-effective, mass-market computer solutions with the requirement for dealing with massive amounts of video data. The industry experienced the first of three waves of technological change in the mid-1970s, when the advent of portable video cassette recorders, edit controllers and digital TBCs brought about the change from film production to tape. As digital video compression technologies improved in the mid-to late-1990s, some manufacturers introduced systems that relied on multiple proprietary elements. This was necessary because the standard technologies of the day were not powerful or fast enough to handle the demands of broadcast news production. Many of the proprietary solutions were designed around large and expensive central server systems. At the same time, much work was done to determine acceptable levels of compression and to establish standards for compression. Today, MPEG and DV/DVCPRO compression formats are routinely used for news acquisition and contribution. The formats used are similar enough that they may all be processed through the same networks and CODECs, greatly improving the economics of system design.

As a result of advances in standard off-tape data rates, drive capacities and networks, we are today entering the third wave of broadcast technology. Using off-the-shelf PCs, networks and storage it is now possible to construct a third-wave digital news production system that rivals the performance of the central server systems of the second wave, but at a price point that reflects the use of mass-market computer solutions and technologies.

A standards-based solution

The Vibrint product line of the Grass Valley Group offers an example of such a third-wave solution. The system is composed of individual PC workstations with Windows NT applications designed for feed capture, editing and playback. Each workstation is a standard off-the-shelf Intel Pentium PC running the NT operating and file system. The system supports standard storage solutions and standard TCP/IP file transfer and gigabit Ethernet networking protocols. Each workstation is equipped with standard SDI and analog inputs and outputs.

The workstations currently support MPEG-2 elementary stream video compression. MPEG-2 files may be transferred via network to the Grass Valley Group Profile or another video server. The application has the ability to search for clips and sequences and pull them from MPEG Profiles on the network. By the end of the year, a new off-the-shelf CODEC board will offer simultaneous support for both MPEG-2 and DV/DVCPRO. There will also be an optional SDTI/SDTI-CP I/O that will be capable of 1-4X transfers when connected to tape decks, servers or routers with this feature.

The Vibrint applications include an interactive feed capture system, a nonlinear hard news editing application and a low-cost, manual news playback system. As an alternative to the Vibrint applications, broadcasters can choose to interface with the Profile XP Media Platform for news ingest and playback, as well as other video servers.

With support for both MPEG and DV/DVCPRO, the workstations allow for integration with a wide range of broadcast systems and equipment. To that end, Grass Valley Group and Vibrint have played an active role in proposing standards for file transfers and metadata. As these and others are adopted and broadcast products evolve into more of a third-wave, standard computer model, broadcasters will see the cost curve decline dramatically and performance increase.

Benefits of standard technologies

A standards-based solution offers significant benefits to broadcasters beginning the move to computer-based news production, including:

- Greater flexibility: A system based on a standard platform offers the flexibility of choosing from a variety of applications that run on that platform and running multiple applications on a single system.

- Simplified maintenance and easier upgrading: As technology advances and new products become available,
they can be integrated more easily. Off-the-shelf systems parts and components are available from many sources in addition to the company that originally supplied them, making it easier and less expensive to repair and upgrade.

- Distinct cost advantages: As consumer and industrial use of PCs grows, the price point of standard technology drops tremendously, as well as the costs of corresponding peripherals.

- Easier integration of new capabilities: Traditionally, the broadcast news environment functioned as a loose collection of isolated work groups with discrete, yet parallel, tasks such as story writing and video editing. The third-wave workstations bridge the gap by providing links between video production and text-based systems such as Avstar and EPNS on a single PC.

Later this year, we will also see low-resolution, software-only applications offering journalist desktop browsing and editing functions. The new applications will run on the existing Windows NT desktop integrated with the newsroom computing system. Because

they will not require specialized video boards, many broadcasters will be able to roll out the new capabilities without investing in new hardware.

An alternative to central server solutions

Today you will find second-wave digital news production solutions in operation. They will typically have proprietary computer elements. Most of these systems also use proprietary file and operating systems, as well as proprietary networks, and are not truly open and interchangeable. Many rely on now obsolete processing chips with no ability to upgrade, custom designed network protocols and a custom file system. If the system is truly open, you should be able to manage your media files on your PC, with the ability to copy and send them over a network just as you would with a Word document.

Advances in standard technologies make it possible to create a broadcast news production system, such as Vibrant NewsEdit, entirely with off-the-shelf products.

As you move your news production system to current computer-based technologies, make sure you invest in a system that truly capitalizes on and delivers all of the benefits of open and standards-based technologies.

For more information on Vibrant's digital news production applications, circle (453) on the Free Info Card.

Roland Boucher is director of marketing for Grass Valley Group News Products.

Circle (141) on Free Info Card
Pinnacle's PDS 9000: Integrating switcher and DVE technologies

BY PAUL TURNER

Production switchers as we know them have been around since the early 1960s. Using state-of-the-art analog circuitry, they evolved over approximately 20 years into highly complex video compositing engines. As their level of complexity grew, so did the difficulty of maintaining them. In the mid-1980s, digital production switchers started to make their entrance. By and large, these were merely digital copies of their analog counterparts. With the high cost of digital circuitry at that time and the enormous power consumption of TTL chips, only the wealthiest customers could afford to purchase and run these digital switchers. While the price has definitely dropped, production switchers today have added few new features to those of their analog ancestors.

DVEs are a more recent development. They grew from the technology of early frame synchronizers and were digital devices from the start. Based on the idea of storing an entire field or frame of video and then manipulating the physical location of each pixel in the stored image, they opened up a world of possibilities for effects in television.

Being so different in the basic nature of their functions — the production switcher to mix together elements to provide an entire look and the DVE to provide enhanced special effects — the two devices have evolved separately. Once production switchers became digital in nature, however, this seemed to be an artificial boundary. It has long been the dream of manufacturers to produce a device that integrates the functionality of switcher and DVE into one processing engine. The PDS 9000 is the first production switcher to truly achieve this goal.

The M/E is the DVE processing.

Methods of integration
Many manufacturers integrate DVEs into their production switchers by connecting stand-alone DVE systems into the video path of the switcher through the use of aux buses, effects send systems, etc. The only real integration offered here is that the external DVE can be controlled from the switcher's control panel. The two devices remain physically separate entities, and much of the potential power of the combined system is lost. Moreover, this "box within a box" architecture usually dictates that the number of DVE channels within the switcher be limited, so some form of delegation is required in the switcher setup. This means that DVE channels may not be available when the operator needs them, because they are tied up in other areas of the switcher.

Integration of M/E and DVE processing
The PDS 9000 is the first switcher to truly integrate DVE functionality into its video path. The M/E processing is the DVE processing. This is due to the system's incredible "building block" ASIC. Pinnacle's proprietary video processing technology allows M/E functions and DVE functions to be combined in a single chip, the K2. K2 includes mixers, color correctors, keyers, filters, address generators and interpolators in a single building block. This building block is fundamental to the compact size and low power consumption of the system. (The video processor chassis draws approximately 400W with all options installed.) Every M/E in the system is equipped with three full-function DVEs — one on each keyer and one for the main transition engine. The user never has to delegate a DVE to a keyer — the keyer already has one.

System architecture
The general architecture of the PDS 9000 is quite traditional in overview (see Figure 1). Serial digital signals are received, deserialized and equalized by the system's eight I/O boards, each providing processing for five inputs and three outputs. The input signals are then fed to a crosspoint matrix, which routes them to the M/E processors. There are three identical M/E processors in the system — one for each M/E and one for PGAM/PST/DSK. All processing associated with an individual M/E resides on the M/E card itself. This leads to simplified maintenance requirements - in the event of a failure in an M/E system, the entire M/E is simply...
replaced with a new board. Boards may even be swapped within the system to assist in more complicated troubleshooting tasks. Finally, the video outputs of the M/E boards are sent back through the crosspoint matrix to the I/O cards. Figure 2 is a simplified block diagram of the PDS 9000's M/E architecture.

M/E architecture
Each of the four buses in the M/E pass through a color corrector circuit. This is used for both input proc amp functions and, in the case of the keyer paths, for YUV and optional RGB color correction functions. The A and B background signals (PGM and PST in the PGM/PST/DSK system) then pass on to the final mix/DVE stage.

The key signals are passed to the key/DVE portion of the M/E. If the DVE is not required, it is simply bypassed and adds no delay. If the DVE is required on an individual key bus, it is enabled before the key is passed on to the final mix/DVE stage. Note that the DVEs operate on both fill and key signals, in 4:4:4 mode for the highest signal fidelity.

The two background signals, along with the two key elements, are combined in the final mix/DVE stage. This DVE is used purely for transition effects, allowing the user to perform DVE transitions in exactly the same way as they perform wipes. Finally, the output signals are passed back to the crosspoint.

This architecture truly combines DVE processing with traditional M/E processing. The DVEs do not use the I/Os of the system — they are simply part of the M/E itself.

Through the use of advanced signal processing technology, the PDS 9000 dispenses with the idea of picture transformation being separate from mixing, keying and wiping. By placing this technology deep in the video path of the mix/effects, the PDS 9000 allows the user creative freedom.

For more information on Pinnacle's PDS 9000, circle (452) on Free Info Card.

Paul Turner is broadcast business manager for Pinnacle Systems in Mountain View, CA.
Grass Valley Group’s Kalypso video production center

BY MARK NARVESON

Today’s live and post-production environments are increasing in complexity, placing heavier demands on production equipment. Customers who want to maximize production value and revenue streams are using existing installed equipment with varying degrees of success. Customers face four major challenges as they plan the production flow for new programming.

First, today’s sophisticated look requires more graphics, animations and effects to be on-air simultaneously. These range from traditional graphics to newer looks that include identification logos, ticker tapes and sidebar animations. Second, some productions require more mix/effects (M/E) banks to pre-configure composited shots for the director to view and make course corrections before airing. In general, more M/E banks mean more directorial choice and smoother production flow. Third, customers want customized feeds for multiple usages or end users, each with customized graphics and without the need for extensive post production. Finally, technical directors increasingly need to have control over all the elements of live production, including VTRs and DDRs, video buses for such applications as video in wipe border, masking from a video source and secondary background transitions. Also available are up to six channels of internal DVE; a 100-frame, eight-output frame store with integral hard drive storage, and animation capability. These features allow customers to reduce or eliminate their dependency on external DVE channels, still stores and logo animators.

### Customers face four major challenges as they plan the production flow for new programming.

#### Increasingly complex production value

In today’s production environment, there is a strong need for more video inputs, more keyers, more storage for still frames or animations and more flexibility in the output system. The Kalypso Video Production Center offers up to 80 CCIR-601 compatible inputs to accommodate large numbers of camera, VTR and other sources without the need to switch external router destinations during a live program. Up to 46 programmable outputs can be configured to provide any desired set of M/E or auxiliary bus outputs. A large number of auxiliary buses can be used for such applications as monitor wall control directly from the main switcher panel, in some cases reducing the number of facility router destinations into the control room. Each M/E features four keyers for more graphics layering capability, as well as two utility router destinations and two M/E keyers for animation, graphics overlay, pattern generation and keying. Kalypso’s new DoubleTake Split M/E technology allows any or all mix/effects banks to be divided into two separate M/Es with independent transition mixers, F-MEM Effects Memory systems and preview outputs. The power of eight M/Es is now available from a four-M/E system.

### Need for more M/Es

Many applications require more M/Es than current production switchers can offer. For example, in sports programming one M/E may be devoted to an ISO feed for recording the clean program with the game clock - useful in replay applications. Directors may also want to see four to six camera and/or VTR sources with the correct graphics simultaneously to have more options to take to air, rather than the one to three M/Es usually available. This is useful in news where a director may want to see both anchor shots, the weather chroma key, the live remote, the sports desk and the satellite feed — all ready to go to air with appropriate graphics. Kalypso’s new DoubleTake Split M/E technology allows any or all mix/effects banks to be divided into two separate M/Es with independent transition mixers, F-MEM Effects Memory systems and preview outputs. The power of eight M/Es is now available from a four-M/E system.

### Multiple distribution streams

Clean feed systems are used to differentiate between two or more clients, distribution streams or purposes. For example, a taped version of an event...
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Technology issues
Implementing these technologies is complex and must take into consideration key elements of a transmission network that was designed for voice traffic. There are also constraints within the video signals being transported which must be addressed. Addressing the following issues makes local area and wide area networks feasible:

- Jitter. Jitter is cumulative in nature and therefore aggregates in larger networks. Increasing signal jitter leads to reduced noise margin, which in turn produces higher error rates and less reliable communications. Jitter tolerance, jitter attenuation and intrinsic jitter characteristics are important considerations when selecting terminal equipment.

- SONET/SDH pointer adjustment. SONET/SDH networks use a synchronizing mechanism called pointer adjustment that can result in the insertion or removal of several bytes of information to compensate for clock drift between terminal equipment. This can lead to video transport problems such as loss of video synchronization and image tearing unless appropriate steps are taken in the design of the transport terminal equipment.

- Pathological signals. The SDI signal was not originally specified for fiber optic transmission, leading to conditions that can generate a long string of ones or zeroes. These signals can lead to loss of signal lock at the transmitter or receiver. Additional signal processing overcomes this problem, but any method used must be reversible, so that the end user signal is identical to the transmitted signal.

- Optical budget. SONET/SDH networks have tightly specified optical characteristics. Local systems using fiber directly at 270Mbs must also be carefully designed. The distance a signal can be carried on any fiber network depends principally on the optical power launched at the transmitter, the attenuation and dispersion characteristics of the fiber, and the sensitivity of the optical receiver.

Many companies offer fiber transport products designed only for short-haul or intrastudio applications. These products are generally not designed to meet stringent performance and reliability requirements for deployment in carrier networks.

- Network management. The efficient operation of large networks requires comprehensive network management facilities. The SONET/SDH network itself offers a network management system, so the use of this network as a back-bone holds additional attraction. However, the terminal equipment management system needs to be integrated so that monitoring, fault isolation and reconfiguration of the network can be quickly and reliably performed.

- ATM or IP Networks. ATM and IP transport technologies offer some attraction to carriers since they can potentially transport mixed traffic services on a common network. However, there are some specific problems such as the potential for differential delays for real-time video signals.

Virtual Studio Networks has the potential to change the way movies and television are produced by permitting collaboration communities to be spread across the globe. Production effectiveness can dramatically increase. The same benefits that uncompressed digital video transport networks bring to the production community can also be extended to the broadcast community.

For more information on Video Products Group's Virtual Studio Network, circle (454) on the Free Info Card.

Steven Storozan is vice president of Video Products Group Inc.
Video Product Group’s Virtual Studio Networks
BY STEVEN L. STOROZUM

In the world of television technology, change tends to be revolutionary; witness the advent of digital television and new media. However, human nature prefers an evolutionary approach to change, and the human side of the television industry is clamoring for stability in the sea of changing technology. One of the most human processes in television is the editing process. Technology has been rapidly advancing in this area, but editing is still done by collaboration between the editor and other artists involved in the production.

One challenge in editing is gathering and considering the appropriate input given time and budget constraints. The approval process can be repetitious and long. A new editing tool, the Virtual Studio Network, has the potential to make the process smoother and more effective.

Application examples
Applying a networked system to the editing process allows the client to interact with the editor while both are removed from the actual content. Until now, problems with video quality, timecode and audio synchronization have prevented the application of the system.

Quality levels in editing need to be very high, as approvals are done on final output from the edit suite. Consequently, long-distance transport of contribution/mastering-quality video signals is required, along with the accurate, synchronized transfer of control and sound information.

Editing is still done by collaboration between the editor and the other artists involved in the production.

Video Product Group’s VPG-8000.

Services exist which provide the feeds needed to connect studios to post facilities and enable real-time, contribution-quality video/audio editing with the required data signals. Embedding audio and data maintains absolute synchronization on all switched in and out at will or on schedule, gathering all long-haul interfaces in the central office.

Uncompressed long-haul interfaces are possible through the use of synchronous optical network (SONET)/synchronous digital hierarchy (SDH) technologies. SONET/SDH transport systems are currently provided throughout the world, delivering bandwidth in multiples of 155Mb/s between central offices and from a central office to customer premises. DWDM permits 40 or more independent signals to share a single fiber, with each signal having a bandwidth as great as 10Gb/s. DWDM greatly increases backbone bandwidth for voice, data and video applications.

When uncompressed video transport is combined with embedding technology, long-distance collaborative editing is feasible and easily implemented. As the cost of high-bandwidth SONET/SDH circuits is driven down by the advent of DWDM technology, this system becomes increasingly affordable.
may have different graphics than the live broadcast version or a live production may be simultaneously broadcast with graphics in two different languages. Clean feed systems typically offer customization over one to four keys, but this is often not enough. The fallback position is to utilize a second production facility with a second crew - doubling the control room expense. Kalypso's FlexiKey Programmable Clean Feed technology gives producers the ability to fully customize two program streams for two different clients. Automatic key substitution offers the ability to automatically bring up a Spanish graphic on the secondary output when the corresponding English graphic is taken to air on the primary output. One technical director can easily produce both programs on one production switcher.

More control from one location

Technical directors are often called upon to control more on-air devices such as VTRs and DDRs, requiring more powerful device control features at their fingertips. This may be as simple as a customized button panel that plays VTRs to air at the appropriate time. More sophisticated configurations may employ an auxiliary control panel that can set cue points, jog forward or backward, and manage DDR clip stacks. The Kalypso system's main control panel features a device control window next to the program/preset bank, allowing access to Profile video clips as well as VTRs. Clip stacks can be managed to auto cue the next clip once the current clip is taken off air. In addition, the user can choose to automatically play a clip when the corresponding device is taken to air.

The Kalypso also keeps the same look and feel as traditional Grass Valley Group production switchers, minimizing the training period for those familiar with other digital switchers from the Grass Valley Group. More advanced operations can be added to the mix as the technical director becomes more familiar with the capabilities of the system. This, coupled with integral control of external devices such as the Krystal and GVeous digital effects engines and SMS-7000 router destinations result in the most powerful production system on the market today.

The Kalypso Video Production Center is offered in a four-M/E version, as well as a new two-M/E version ideal for small- to mid-size live, post and remote truck production that was introduced at NAB2000.

For more information on Grass Valley Group's Kalypso, circle (451) on the Free Info Card.

Mark Nivensam is the product marketing manager of video production systems for Grass Valley Group.
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Rocket Network takes audio production beyond the boundaries of studio walls, making connections that let you work with anyone, anywhere, anytime. It’s like a global multi-track.

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Rocket Network uses the Internet to allow professionals to work together on audio productions without having to be in the same physical space. Instead of shipping tapes from place to place or renting high-capacity phone lines, you log into your Internet Recording Studio, where Rocket Network handles the details of passing your parts to others and vice versa. That leaves you free to concentrate on capturing the perfect take, using your own local system to record and edit. Whenever you’re ready for others to hear your audio or MIDI parts, you simply post your work to the Internet Recording Studio, automatically updating everyone else’s session.

**Full Audio Fidelity.**

With Rocket Network, there’s no compromise in audio quality—the system handles files in a vast range of formats and compression levels, all the way up to uncompressed 24 bit/96kHz. And you don’t need access to a super-fast connection; DSL or T1 is great, but you can also work productively over a humble 28.8 dial-up. The system supports multiple user-defined presets for posting and receiving, and handles all conversions, letting everyone participate in their own preferred format. That means you can conduct a session in a speedy, low bit-rate “draft” mode, then move on while the final parts are posted in the background at full-fidelity.

**Professional Tools.**

Through partnerships with leading audio developers, Rocket Network is bringing RocketPower™ to the professional tools you already use, starting with Steinberg Cubase VST and Emagic Logic Audio. A multi-level permission system lets you control access to your Internet Recording Studio. And our RocketControl™ client offers built-in chat capabilities, so everyone in the session can chime in with feedback as the project takes shape. The Rocket Network Web site offers additional resources and services for audio collaboration.

**A Powerful Connection.**

Rocket Network adds a new level of freedom to creative collaboration, allowing you to choose your team—singers, musicians, voice-talent, composers, engineers, producers—based on who’s right for the project, wherever they happen to be. With full fidelity, plus anytime, anywhere productivity, Rocket Network is a powerful new connection to the world of audio production.

Escape the boundaries of your studio walls.

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Herbert Zettl would be extremely jealous of the options available to the program production professional of today. Zettl wrote the definitive textbook used for generations studying television production. Among his most creative ideas was a method to do a “wipe,” using a single camera and a mirror carefully placed to show a second set when it was pushed in front of the camera. Imagine the care needed to be sure you weren’t showing the public the production crew instead of the second set. Remember, this would have been live and in black and white. Zettl had plenty of other creative ideas that survived as common operational practices for decades.

Zettl would be truly amazed at many of the common video mixing tools available to every segment of the market. The recent maturation of computer-generated special effects would have been unthinkable, and even digital effects would have been hard to imagine. Live television remains a challenging arena for professionals, and in some ways even more creative, though perhaps less exciting than moving mirrors required.

The complicated nature of on-air production switching used for news, special events and sports broadcasts has continually pushed manufacturers to new heights. When the first GVG 1400 solid-state production switchers became available (one is on display in the lobby of the GVG headquarters for those of you who have never seen one), the effect on live production was immediate and predictable. If effects, limited to simple wipes and keys, as well as additive and non-additive mixes, could be done in such a stable platform then how much more could be pushed into the technology. GVG, Vital, CDL, Ampex and other manufacturers of that era moved the bar ever higher pioneered by Vital allowed Zettl’s creative visualizations to be accomplished in the quiet of the control room without complicated staging. Over the next generation, digital effects matured and digital processing moved into the mainframe of the production switcher.

Today, it is indeed hard to buy an analog production switcher because digital techniques have become so powerful and cost effective that analog designs no longer have a place in the live market. Analog production switchers were endowed with literally hundreds of intricately interrelated adjustments that had to be considered in the correct order to achieve adequate performance. As digital technology became available, reliable manufacturers were able to recast the assembly process. Instead of burn-in and labor-intensive tests and final adjustments at the factory, it became possible to burn in the digital processors without assembling into a complete system, and final test has become essentially a programming and performance verification process. The result has been to allow vastly more complex capabilities for the same money, or alternatively prices that were unthinkable even a few years ago for capabilities that are quite remarkable.

In the last year even the complicated 3D computations and filtering that are required for digital effects manipulations have moved into the switcher itself, allowing seamless control over layering and transformations of three dimensional space. Transitions between layers or scenes now can include special transformations as a normal course of production, without large price or flexibility trade-offs.

At the same time the increase in capability of new production switchers has spawned a rapid increase in the complexity of on-air product. Animated graphics are now the norm in sports production, and news programs have evolved into a production signature look that would be difficult to reproduce with technology available just 10 years ago. We have in fact entered the third generation of digital production switcher hardware from some manufacturers.

Much of the new capability in digital production switchers is driven by the integration of digital signal processing technology and custom-designed arrays, which allow the complexity to be reduced to a set of programmable “picture modifiers.” For instance, the introduction in the 1980s of infinite re-entry to analog production switchers became possible only with considerable complexity. The same capability in digital switchers
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is as much a matter of software as system architecture. Some manufacturers have licensed sophisticated chroma key capability as software for incorporation into switcher designs.

Some manufacturers have implemented their designs using general-purpose computer platforms and off-the-shelf operating systems like Windows NT. Others have chosen to use real-time operating systems like VXWorks. Neither choice should be viewed as inherently flawed, for it is the integrated whole that must be reviewed. At the risk of overstating the obvious, there is no such thing as bug free software. Every manufacturer has suffered some birthing pains with new hardware and software in production switchers. The most important question to ask the switcher salesman is whether bugs cause either the loss of output video or potentially force a “reboot” that will take considerable time and certainly affect the output picture. At least one manufacturer has thought ahead and provided a cuts-only bus that can operate independently in the event the main switcher requires a “three finger salute.” While clearly this is an admission of fallibility, it is a refreshing admission.

Remember the old analog switcher you installed in 1985? The control panel used multiple connectors each with dozens of pins. Today, you can install a single Category 5 cable to control one manufacturer’s control panel. It is possible to buy a second control panel on one manufacturer’s design and then assign part of the panel to each control panel. This has appeal where simple productions may originate from a second studio, at the same time as a more complex production in the main control room. One electronics frame with two users is very appealing. To be fair, Abekas first implemented this idea in the 1980s. Recently, the landscape of production switchers expanded with a crop of four mix effects designs, as well as families of switchers that include standard definition (525 and 625) designs, as well as HDTV variations. Two manufacturers have shown this concept with identical operator interfaces for either electronics frame. This is particularly appealing when a control room might be installed for SDTV today and converted in the future for HDTV use. It is even possible to switch between formats without disrupting the operator’s interface, which is intriguing when considering system evolution implications.

It is valuable to note that one European manufacturer has implemented I/O capability that will accept not only all variations of HDTV carried in SMPTE 292M (1080i/30, 1080p/24 and 720p/60), but also 480p/60 and allegedly 480i/30. I say allegedly because I have yet to see it working, but the design seems capable of this enhancement. If other manufacturers implement similar designs, clients will certainly win.

One recent design implements two operating modes that allow either conventional re-entry style compositing or extended layering. This concept is not new, having first been used in the 1980s in designs from GVG and Abekas (both products are no longer available). These designs were intended for post production, and are still used today.

It’s pretty incredible when you consider the cost of current designs is lower (in almost all cases) than similarly sized and equipped analog designs. Modern designs are providing new capabilities, higher reliability, freedom from drift, and the highest possible picture quality, yet prices in deflated dollars are down considerably. Seems like digital switching has moved into the mainstream to stay.

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Jensen Transformers ISO-MAX CO-2RR: newest in Jensen’s ISO-MAX line of isolators, eliminates hum in audio systems; neutralizes ground loop problems occurring within audio signals with a turnkey interconnect solution; the CO-2RR provides users with 15dB of headroom at 20Hz; 818-374-5858; fax: 818-763-4574; www.jensen-transformers.com

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**FACILITY MANAGEMENT SYSTEM**

Xytech Systems Web Browser Module: latest addition to the Enterprise facility management system allows film companies, broadcast studios and production houses to access

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Unlock The Power Of Time Division Multiplexing

True power is the ability to control — and that’s what the new ENVOY7256 router with Time Division Multiplexing (TDM) technology gives you; unequaled power to control your digital audio signals. With single channel switching with gain control, channel summing and phase inversion of up to 512 channels (256 AES) in a single 14 RU frame, the possibilities are endless.

The TDM matrix allows individual mono channels to be swapped from any input pair to any output pair regardless of size. Linear expansion to multiple frames now becomes effortless. With just one additional 14 RU 512 frame you’ve doubled your routing size to 1024. With just four 14 RU 512 frames you’re now at 2048. There are no additional audio DAs or secondary switching systems to worry about and expansion interconnections use standard coaxial cables. In a digital environment where being out of control can spell disaster, the ENVOY7256 router gives you the power that puts you solidly in control. And it’s only available from the people that have DTV down to a science. ADC.

For more information call (800) 726-4266 in North America or (530) 265-1000 worldwide, or visit our website at www.adc.com/broadcast.
facility information over the Internet; users of the system can access information such as studio and production schedules, and location information from anywhere in the world, as well as tracking their own information online; 818-767-7400; fax: 818-767-7430; www.xytechsystems.com
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DIGITALBETACAM VIDEOCassetTES
Quantegy DBC: high impact cassette mechanism for ENG/EFP or post production applications; features a coactive site binder system to improve cross-linking and reduce debris; incorporates polyurethane molecular binder and matrix lubricant system for a smooth tape surface; small and large cassette sizes offer play times of six minutes to 124 minutes; 800-752-0732; 334-745-7643; fax: 334-742-6091; www.quantegy.com
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DIGITAL TELEPHONE INTERFACE
Telex Communications RTS TIF-2000: designed for use with all RTS digital matrix intercom systems; features an auto/ manual answer mode and direct call-in to party lines and IFB circuits, as well as direct audio input mixes with matrix audio; calls can be placed on hold and accessed individually or all at once through talk and listen keys on the RTS keypanels; TIF status is displayed on the TIF-2000 front panel; 800-392-3497; 612-884-4051; fax: 612-884-0043; www.telex.com
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COAXIAL KEYPANEL INTERFACE
Telex Communications RTS CSI-200: allows users to connect RTS Matrix keypanels with intercoms via a single coaxial cable; interfaces provide two complete, independent interfaces in a 1/2RU box, converting send and receive audio signals from balanced analog to a 48kHz, 24-bit signal, and a bi- directional data; all these are then transported over a single coaxial cable; 800-392-3497; 612-884-4051; fax: 612-884-0043; www.telex.com
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ASSET MANAGEMENT SYSTEM
Vecta AMS: is an NT-based system providing backup and archiving to standard SCSI devices, C2-level security and multiple-criteria database searches; the system also offers seamless integration with Vecta DTV Stillstore; users can also view stored images from remote clients through an Internet browser, and utilize centralized reference storage and archival of still and graphic images; 800-706-0077; 310-581-8800; fax: 310-581-8808; www.avicatech.com
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When our readers tell us about Broadcast Engineering, they say it's the best place to get current and reliable information about the television, cable and production industries. Just ask Dr. Corey Carbonara:

“One of the biggest challenges of my job is keeping up with the developments in DTV.
“I believe it is vital to keep abreast of these new developments and technical breakthroughs.
Broadcast Engineering always has comprehensive coverage and in-depth analysis of issues that are technical in nature.

“Broadcast Engineering provides a high-definition of clarity on DTV issues.”

Dr. Corey P. Carbonara
Associate Vice President for Technology Management; Executive Director, Institute for Technology Innovation Management, Baylor University
### Video Demodulator

**msi 320** | **Tek/Rohde**
---|---
Differential Phase | 1.2° | 2°
Differential Gain | 1% | 2%
ICPM Accuracy | ±2° from 75° to 105° | not specified
Aural Signal Demodulation | Visual carrier not required | Requires a sync modulated visual
Zero Carrier Reference Line | User selectable between 11 and 36 | Must be factory set

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**Here's what you'll find when you compare the msi 320 with the Tektronix/Rohde demodulator:**

But don’t just take our word for it. Put the **msi 320** side by side with the demodulator you’re using now. If it’s a legendary 1450°, you’ll find the performance of the **msi 320** nearly identical. If it is anything else, you'll find there’s no comparison.

Don’t wait. Just tell us you want to try the **msi 320** with absolutely no obligation. We’ll send you a demo request form. Fill it out and return it, and we’ll send you a demo unit that you can test and evaluate. It’s that easy. If you have any questions, we’ll even help you set up a valid comparison test.

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**You'll be glad you did.**
HD UNCOMPRESSED VDR
DVS Digital Video Systems Inc ProntoVision 2000: successor of the ProntoVision allows real-time I/O and storage of uncompressed HDTV content; new generation fits into a 4HU case; contains built-in video disks holding up to one hour of video and audio; supports common HDTV rasters — 1035i/1080i, 720p, 1080p/24, 1080p/30 and 1080sF/24; features a real-time color space converter allowing for YUV/4:2:2 and RGB/4:4:4, with in and outputs in YUV and RGB; can be operated as a stand-alone device or in connection with a host computer running Windows NT 4.0, Windows 2000, Linux or Solaris platforms; 818-241-8680; fax: 818-241-8684; www.digitalvideosystems.com
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225-4500KVA UNINTERRUPTIBLE POWER SUPPLY
MGE UPS Systems EPS6000: offers large-scale, continuous operation power backup for broadcast facilities; protects Internet and broadcast facilities from power outages and provides power conditioning to smooth out periodic power line or weather-related disturbances; handles the "crowbar effect" caused by broadcast transmitters by means of high surge circuitry and a 100 percent rated static transfer switch; features Insulated Gate Bipolar Transistors with MGE's Digital Power Quality micro circuitry; 800-523-0142; 714-557-1636; fax: 714-557-9788; www.mgeups.com
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DTV TRANSMITTER TEST SYSTEM
Harris CD Eye: now shipping from Harris, an integrated digital transmitter test system; a software-based system that provides measurements for spectrum, out-of-channels mask, eye diagram, constellation, signal-to-noise ratio and error vector magnitude, pilot level, nonlinear analysis and real-time adaptive correction metrics; 800-622-0022; 513-459-3400; fax: 513-459-3890; www.harris.com
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MULTIMEDIA SERVERS
Alex Temex Multimedia Libra servers: now shipping with the Linux operating system, scalable, modular servers offer easy access to multimedia via LAN networks; parallel architecture eliminates duplication of stored data; 714-147-1695; fax: +33-4-50-64-09-02; www.alex.com
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MicroNet Technology SANcube: now shipping, the serverless storage network offers fast connectivity and fast, reliable storage for project collaboration on Power Mac G4, Power Mac G3, PowerBook and iMac DV systems; transfer rate is 30Mb/s; 949-453-0673; fax: 949-453-6071.
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You already have enough to think about when choosing a video server system. So here's some straight talk. The SeaChange Broadcast MediaCluster™ is the most reliable in the industry. Without costly mirroring. That's the better thinking engineered into SeaChange's entire family of MediaCluster servers, delivering MPEG-2, 4:2:2 video at bit rates up to 30Mb/sec. With rock-solid solutions starting well under $100K, you can buy into open standards and networked solutions that offer real opportunities for streamlining your single or multichannel operation. We won't dazzle you with the configuration diagrams here. Visit www.seachangeinternational.com. And see why we're playing on 27,000 channels worldwide.
Professional Communications Systems was chosen by WTVC-TV to provide systems design and integration for its new broadcast facility in Chattanooga, TN. PCS installed equipment including Panasonic DVC/PRO 25/50 VTRs and routers, and switchers from the Grass Valley Group in the new digital facility.

PCS is also providing systems design and integration services for NBC affiliate KCEN-TV in its transition to digital.

Total Video at Houston Studios recently purchased a DVC/PRO camcorder and HD studio VTR from Panasonic for use in the production of feature films, trailer footage, video for plasma screen display and HD projection.

Panasonic's DVC/PRO PV Series was purchased by WVNY-TV in Burlington, VT. The station is using the digital component camcorders, VTRs and studio players in the acquisition and production of two daily 30-minute newscasts.

Fox Sports Net will also be using DVC/PRO 50 equipment from Panasonic. The equipment will be used to acquire, edit and playback sports programming in Fox Sports Net's regional networks.

Panasonic, Tiernan Communications and Synergistic Technologies have founded Digital Broadcast Resources. The alliance will provide broadcasters with end-to-end digital television solutions encompassing SD and multiformat HD production equipment and systems, critical encoding, and system integration capabilities.

Joint projects taken on by the three companies include an HDTV broadcast of "Monday Night Football" and the ABC HDTV Release Center.

NBC will use Scientific-Atlanta's PowerVu Plus digital video compression system to deliver four channels of backup broadcasts to its network affiliates in the United States.

ALLIANCE ATLANTIS chose Columbine JDS provided integrated management solutions for its four-channel lineup. CJDS' DMAS and Paradigm will be incorporated into a management and automation system for traffic, programming, material management and multichannel automation.

THOMCAST Communications and Evertz recently signed a reseller agreement. Under the agreement, THOMCAST will distribute and market Evertz products including keyers, logo inserters, timecode generators and universal data readers/decoders to the domestic broadcast market.

Avstar and Sony announced a joint solution for newscasters. The project introduces Active-X protocol into the Avstar Newsroom Computer System in order to allow it to coexist with Sony systems. The integration specifically allows for control of Sony’s ClipEdit and NewsBase news server and enables newscasters to access news feeds and draft accompanying text simultaneously.

Artesia Technologies announced that Centerseat has chosen its Teams 3.0 digital asset management solution in its new entertainment and information website, www.centerseat.com. Centerseat will use the system to support secure syndication and content distribution to its broadcast partners, as well as to create a comprehensive digital media library of images, video and audio.

Artesia's Teams solution will also be used by 21e, a Web entertainment broadcasting network, to manage its streaming media content for scheduled and on-demand display.

NBC News recently purchased E5425 SNG encoders from TANDBERG Television to cover major news events worldwide.

Screen Shot

**Axiom-MT records New Orleans jazz**

Sheffield Audio Video Productions recently used Solid State Logic's 96-input Axiom-MT digital multitrack console at the New Orleans Jazz Festival. The MT was utilized in Sheffield's remote truck to capture Sting's performance in 5.1 surround sound. The console was able to flawlessly combine Sting's audio with the HD video of his performance by interfacing effectively and cleanly with the equipment in the video remote truck. In addition, the Axiom-MT's automation enabled a quick changeover between performances, so producers were able to do a sound check in advance and recall the settings that fit for each performance.

**Virage offers interactivity for WB**

The WB television network chose Virage Interactive to allow viewers to interact with the WB's one-hour comedy series Popular. Virage's application services will be utilized to put the first 18 episodes from the first season of Popular on the Web. Viewers can then view specific scenes by searching the material by character, date and episode at www.TheWB.com. They can participate in the Popular Purge by expressing their opinion on which character should be eliminated in the show's season finale, with the most humorous comments integrated into the broadcast of the show.

**AMS Neve console supports Grammys**

Mobile recording specialist Effan Music used a 128-input Capricorn digital mixing console from AMS Neve to record and mix this year's Grammy
Why I’m Here.

"I’m Nat Ostroff, Chairman of the Board at the new Acrodyne. I’m here because of you. As Vice President of New Technology with one of the largest commercial broadcasters in the United States, Sinclair Broadcast Group, we speak the same language. I know what you need.

I saw a good company with good people... Acrodyne had a lot of energy. And a unique opportunity was there to redirect (even recreate!) the company. Rather than making transmitters that large manufacturers want you to buy - designs overloaded with unnecessary complications - I saw a chance to meet the true requirements of broadcasters, like myself, by tailoring Acrodyne’s products, services and support philosophies to broadcasters’ needs. Something the managements of large domestic and international corporations are unable or unwilling to do.

So I brought the team of EMMY award-winning people that originally invented the IOT transmitter technology together again and created the Quantum Line of high power IOT solutions. Knowing what I know as a broadcaster, the Quantum’s simple, elegant and reliable solutions will make your life easier and will set new standards. I believe it’s remarkable.

Acrodyne also signed an exclusive agreement with Rohde and Schwarz, the world’s leading manufacturer of solid-state transmitters, both air and liquid-cooled. This is the first opportunity for my fellow broadcasters to have access to the world’s leading solid-state technology. Again, it’s remarkable.

While we will continue to provide the equipment and support that you already count on from us, the new Acrodyne is committed to bringing you state-of-the-art high power television transmission equipment. At the new Acrodyne, we are anticipating your needs for the future by working along side of you.

We will be moving into our new multi-million dollar manufacturing facility this fall. A facility designed from the ground up to produce the latest transmission equipment for broadcasters.

I am not stopping there. Acrodyne makes it and stands behind it with 24-hour, 7 days-a-week service, technical support, including house calls, and direct access to myself and other members of senior management. This is what I expect from my vendors and you shouldn’t settle for anything less.

As Chairman of the Board at Acrodyne, I’ll talk with you about any new ideas or concerns. You can contact me at nat.ostroff@acrodyne.com. I know what you need, we talk the same language, and I’ll make sure that Acrodyne exceeds your expectations. That’s why I’m here."

What’s new at Acrodyne?
Remarkably, just about everything.

ACRODYNE
The Broadcaster’s Company
FOX News has also selected TANDBERG to provide E5500 DSNG encoders and Alocia professional receivers for use in 110 FOX News affiliates across the United States. The equipment will be used this summer to cover all of the major political conventions.

Tandberg E5500 DSNG Encoder

TANDBERG's evolution 5000 digital broadcast equipment incorporating the E5611 encoder was recently installed for the first time in the United States, by FOX Broadcasting Company. The equipment is part of a digital satellite system worth more than $1.5 million that FOX has selected to provide network programming to its affiliates around the country. The system uses four 36MHz C-band satellite transponders to handle the distribution of 16 MPEG-2 4:2:2 video channels.

Awards telecast. Effanel Music has used the console to record 62 live performances in four Grammy Awards shows, as well as a Dave Matthews Band DVD and the "Divas '99" DVD.

The company recently installed a second Capricorn console for in-studio use, allowing Effanel to mix two projects simultaneously. Live events initially recorded in stereo on Effanel's remote Capricorn can also be remixed in surround on the in-studio console.

Peak software provides museum graphics

Peak Broadcast System's Everest 3D rendering and Pilot template-based graphics software is being used to project HD graphical elements onto walls, video cube displays and plasma screens in the American Museum of Natural History's new Rose Center for Earth and Space. The software is also utilized on a seven-pipe, seven-processor Silicon Graphics Onyx System to composite graphics in the center's Hayden Planetarium on the Digital Dome, the world's largest high-resolution flight simulator.

Sight software is also used to produce "Science Bulletins" covering natural events and Hubble telescope images for widescreen, HD display in the Hall of Planet Earth and the Hall of BioDiversity.

Ikegami cameras capture Mardi Gras festivities

WWL-TV, a Belo station in New Orleans, used Ikegami HDK-790D cameras equipped with new 2/3-inch 2.2-million-pixel FIT CCDs to capture the parades on Carnival Day during Mardi Gras. Eight hours of the festivities were shot in HD from in front of Gallier Hall.

Some of the footage was downconverted for use in the station's four-hour Carnival coverage. The station used HDTV D5 recorders to record footage for a one-hour show broadcast on Belo stations nationwide.

Audio Crosspoints are Now Obsolete

Audio Products
- 1024 x 1024 TDM/DSP Routing without tie-lines. Combine digital, analog, synchronous, asynchronous and remote frame/MADI inputs in a single system...and route them to any output. Up to 60% space savings over competitive models.
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- MADI (56 channel) or 64 channel satellite I/O.
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Video Products
- 64 x 128 I/O High Definition Routers with reclockers & equalization.
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- Copper or fiber on any I/O module.

Control Products
- Hardware Control Panels, Internet control, Java/XML Control Panels, NT Server, second party control and Touch Screens.

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In broadcasting, the equation is simple: more time equals more money.

If you’re a broadcaster, the Time Machine will allow you to make the most of the most valuable asset you have: time.

What if you could create additional time to put on the market every hour of every broadcast day? What if you could do it without affecting program content? What if you could do it without modifying audio or video in any detectable way? What if you could make it happen in real time, with no pre-recording or pre-processing? You can—if you have the Time Machine from Prime Image.

The Time machine means one thing for television broadcasters: more revenue. With our exclusive process, you can easily add a minute (or more) every hour. Which adds up to more availabilities, more sales, and more profits.

It’s time to make more time that will make you more money. It’s time to get the Time Machine from Prime Image.
Kappell and Kostow Architects, P.C. worked with Nickelodeon to design its 33,000-square-foot digital animation studio. Seventy digital animators work in the facility, which houses the production process for two animated children’s television shows, “Little Bill” and “Blue’s Clues.” The facility produces the shows from concept initiation to final production of broadcast-quality tapes.

Elements of the project included production offices, an art department and 53 animation workstations. KKA had to take special lighting, power and communications needs into consideration, as well as creating a detailed system for wire access.

Sennheiser recently opened its first U.S. facility in Albuquerque, NM. The 45,000-square-foot facility currently employs 40 people, but as new products are added that number is expected to grow to over 150 employees.

Leitch’s DFS-300 multiformat synchronizers were chosen to synchronize feeds for Societe Radio-Canada Montreal’s facilities.

Henniger Video recently expanded its DVD production capabilities with technology from Sonic Solutions. Henniger will use Sonic’s DVD Creator for high-end commercial production and feature film DVD encoding and authoring in its Elite Post facility in Nashville, TN.

Lifetime Television’s new weekly game show “Who Knows You Best?” utilizes Mixed Signals Technologies’
When Chicago's Tallest Building Needed 15 Channels* - They Came To the Leaders in Broadband Technology!

Chosen, by TrizecHahn Property Group, for over 30 years of global manufacturing experience, RFS is the leader in broadband technology.

Our broadband RF systems offer the most flexible and customized arrangements for the DTV Market and beyond.

RFS designs and manufactures broadband panel arrays, slot antennas, and combiners for adjacent and non adjacent channels designed to suit your needs. Complimented by a full range of rigid and flexible line along with complete accessories which have been reliably manufactured and supplied to the broadcast market for decades. RFS is your Total Systems Solution provider - come take a fresh look, we will deliver.

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email: info@rfsbroadcast.com
web: www.rfsbroadcast.com

*Customer Requirements: 5 Channel, 7 Channel, and 2 Channel Systems

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www.americanradiohistory.com
Interactive TV technology. The technology allows at-home viewers with set-top boxes running ATVEF-compliant platforms to become real-time contestants on the show.

Mixed Signals Technologies will also provide interactivity for Penn State Public Broadcasting station WPSX-TV. Mixed Signals’ ITV DataFlo System will allow broadcasters to incorporate interactive web links into their programming.

**Hitachi Z-3000W camera**

System integrator TV Magic chose five Hitachi cameras for installation in a $14 million news facility for San Diego FOX affiliate XETV Channel 6. Hitachi also provided three Z-3000W digital 4:3/16:9 switchable cameras to KLCS-TV, a full-power PBS instructional station owned and operated by the Los Angeles Unified School District.

**Media 100** recently formed Stream-River Networks, a streaming media services division with regional centers serving Internet broadcasters, web designers and digital media content creators worldwide. In order to form the new division, Media 100 acquired 21st Century Media, a San Francisco-based provider of encoding, hosting, webcasting, interactive production and streaming media consultancy and J2 Digital Media, an encoding, hosting and streaming services provider based in New York.

**Virage** and PBS announced that PBS will be using Virage’s Interactive application services to offer video content from the NewsHour with Jim Lehrer on PBS.org. The information will be continuously updated and searchable. PBS will also use the applications to distribute excerpts of the content to local PBS stations for use on their websites.

**Tigarto Hare Studios** used **3Dlabs’ Oxygen GVX1** graphics accelerator on **Mission Impossible 2**. The workstation was used on the movie’s title sequence, allowing for real-time approval on the project.

**Inscriber Technology** moved into a new headquarters, giving Inscriber’s research and development, marketing, and production groups twice the space available to them before. The new building is located at 26 Peppler Street, Waterloo, ON N2J 3C4 Canada.

**Denon Electronics** recently moved from its previous headquarters in Parsippany, NJ, into a new 45,000-square-foot facility in Pine Brook, NJ. The new facility is located at 19 Chapin Road, P.O. Box 867, Pine Brook, NJ 07058-9777. The company telephone and fax numbers, e-mail addresses, and website remain the same.

**Angenicus** has sold its 15 x 8.3 high resolution lenses to two Tribune Broadcasting stations — WPIX in New York City and WPHL in Philadelphia. Each facility will use three of the lenses for its ENG crews. In addition, Florida’s News Channel selected the high resolution lenses with Assisted Internal Focus technology for use with the station’s Sony BVP-550 cameras. WFMY, a CBS affiliate in Greensboro, NC, has also purchased Angenicus’ 15 x 8.3 HR lenses, as well as 12 x 5.3 HR Wide Super Zoom lenses.

**Miranda Technologies** and Nortel Networks signed an agreement allowing Miranda to license Nortel Networks’ broadband video technology. The agreement covers the DV-45 series of NTSC DV codecs and DV-MPEG SD7000 MPEG-2 codecs.

Cosmos Broadcasting Group will be installing **Crispin’s** System 2000 station automation package at three of its stations — WFIE-TV in Evansville, IN; KPLC-TV in Lake Charles, LA; and WIS-TV in Columbia, SC. Three more of Cosmos’ stations will have the automation systems by the end of the year. The systems will be used to automate master control functions including record and playback of syndicated and network programming.

Tonal Vision Studios, a sound-for-picture facility based in Baltimore, MD, recently purchased an MFX3plus digital audio workstation from **Fairlight**.
Synergy 1
Digital Performance
Available with Your Choice of Control Panel

Until now, exciting features like "Aspectizers" dual aspect ratio converters & "Squeeze & Tease" 2D DVEs were only available on the award winning Ross Synergy Series line of big digital switchers.

Now you can have these Synergy type features and more on the new compact Synergy 1, a 16 input single MLE digital switcher, the new RVS 210D and 216D digital versions of the popular RVS 210A/216A analog switchers, and... even your GVG* 100 and 110 production switcher.

That's right, you can now upgrade your GVG* 100/110 to digital Synergy power by simply replacing your GVG* frame with a new Synergy 1 digital frame.

Go ahead, say it....Cool!

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Control Panel + Synergy 1 Frame

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DIGITAL PRODUCTION SWITCHER

RVS 210D
DIGITAL PRODUCTION SWITCHER

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Divicom and Geocast have announced a partnership allowing broadcasters to merge Web content and local video content into their digital video streams for broadcast to PC users. As part of the alliance, Divicom will integrate the Geocast solution with DataTrack TM. The Geocast service will enable users to instantly access local information and entertainment, while the DataTrack technology creates a transport channel between the head-end facility and consumers’ set-top boxes.

Columbine JDS and Triveni Digital have jointly developed an interface between Triveni Digital’s PSIP Builder Pro AE-10 and CJDS traffic and automation systems. The interface will allow DTV stations to use information from their CJDS systems to drive the PSIP, eliminating the need for PSIP data to be entered manually. CJDS MCAS automation systems were also chosen for installation in five stations owned by the Sinclair Broadcast Group. Approximately 20 percent of Sinclair’s stations currently have CJDS DAL systems installed. WEWS-TV in Cleveland, OH, has also purchased an MCAS-IV automation system from the CJDS DAL division of Columbine JDS.

Crown Media's Denver-based Hallmark Entertainment Network recently purchased a $700,000 image-store master control and channel branding system from Oxtel. The network will use the system for branding on its 15 new DTV entertainment channels, as part of a global rollout system scheduled to be on-air this year. Hallmark Entertainment Network will transmit multilingual programming via fibre and satellite to the United Kingdom and Europe, as well as to Latin America and the Asia Pacific.

NBC affiliate WNDU-TV recently purchased a RapidAccess MPEG-2 video server solution from Vela to be used primarily for playback of spots and syndicated programs.

Audio-Technica has been selected by NBC and the Sydney Olympic Broadcast Organization to provide microphones for coverage of the 2000 Olympic Games. Audio-Technica will provide NBC with over 200 microphones, and SOBO with over 1000.

CBS-owned-and-operated stations will be the first to make use of Utah Scientific’s new HD-2020 master control mixer. The system will interface with CBS’s proprietary automation system.

A.N.N. Systems has provided its OpenMedia and StarDrive newsroom and asset management systems to FOX affiliate KKFX-TV for use in its new evening newscast. A.N.N.’s OpenMedia and StarDrive systems will also be part of an integrated solution for the acquisition, management and broadcast/Webcast automation of digital media called “News-In-A-Box.” A.N.N. formed a partnership with Leitch in order to provide the complete newsroom solution, which combines Leitch’s digital

Design and Mix a Cable Channel with Revolutionary Multimedia Insertion Technology!

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- Concurrent display of analog video input and MPEG-2 video in scalable, movable windows
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- Back-to-back MPEG audio/video playback with genlock for seamless ad insertion
- Hardware-assisted scrolling and crawling of multiple graphics windows
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MRX™ by Sigma. 32 x 32 = 1 RU, the formula for compact routing.

Sigma Electronics has done it again. Introducing the new MRX Series™ of compact routing switchers. Only one rack unit high – perfect when space is at a premium. And, with specifications that meet the most critical applications.

Add levels and functions as required. Need a channel of audio? ...add a 1 RU, 32 x 32 frame. The MRX™ can switch eight control levels.

A variety of control panels including alphanumeric are available. For computer control via RS232/RS-422, check out our new SigMatrix™ software.

MRX™, the new formula for midsize compact routing switchers. As an added benefit, all components are covered by Sigma’s 5-Year Parts & Labor Warranty.

Contact us now for product information or to locate your nearest Sigma dealer.
video servers and NLE technology with A.N.N.‘s newsroom products.

Sunset Digital Studios, a post-production facility specializing in feature film mastering, made-for-television movies, music videos and commercials, installed the ARTEMIS digital audio workstation from SADIE in its digital mastering suite. The ARTEMIS is currently being used for DVD soundtrack mastering, Dolby E mastering, and digital restoration and mastering of motion picture/television soundtracks.

**AMS Neve**’s Libra Live Series II digital broadcast console was chosen by Time Telepictures, a division of Warner Bros., for installation in its digital production facility. One will be installed in the existing Studio A, while the other is scheduled for installation in the new Studio B.

MTV Networks also purchased a Libra Live Series II for installation in their Studio B control room. The console will be used for MTV program Total Request Live and live MTV studio performances. It was also be utilized for MTV’s New Year’s Eve special.

**PEOPLE**

Solid State Logic appointed Claire Hall as national sales manager of broadcast products for the United States.

Jeff Gibson was promoted to vice president of sales for Extron Electronics.

Vela announced two executive promotions. Bill Robertson was promoted to vice president of technology, marketing and planning for Vela, and Carl Gardner was promoted to vice president and general manager of Systems and Broadcast Products.

Bart Petrini was named president and CEO of Communications & Power Industries.

Hitachi recently appointed two top executives to its Industrial Video Division — William Liento as vice president and Phil Gant as director of marketing.

Bernard Lechner was recently honored as the first recipient of the ATSC Outstanding Contributor Award. ATSC Chairman Robert Graves announced that the Bernard J. Lechner Outstanding Contributor Award will be given annually.

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Television Engineer


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BY PAUL MCGOLDRICK

It used to be that broadcast engineers measured things using a meter, a scope or a spectrum analyzer and then agreed upon the readings. If we hadn’t, there would never have been any completed acceptance tests for new equipment, and the FCC would never have been able to establish routines for proof of performance. When a new specification was required, one was invented or designed, approved in committee, and applied evenly in the broadcast workplace.

If there were differences of opinion in committee then it was not unusual for a practical demonstration to be set up at the next meeting so that a point, or practicability, could be proven to the other members. Of course, there were always things that came back to bite us at a later date — like measurements of subcarrier phase referred to lines where there was no subcarrier — but at least the decisions were made and we moved on.

However, we now seem to have entered a world where engineering has become opinionated, perhaps colored, by financial or political interests.

The principal arenas of dispute recently are low-power FM, 700MHz interference and, of course, 8VSB vs. COFDM. The first seems to be a basic argument about interference issues between the FCC on one hand and NAB/NPR (strange bedfellows) on the other. Both sides have produced figures that should be easily confirmed with independent testing, but there is absolutely no give from either side. Certainly from a casual look at the issues one would have to say that the NAB/NPR faction appears to be unaware of FM’s capture effect. If the issues are really about squashing competition then we have a misuse of engineering information. But if the FCC side has fudged the numbers then we have a political agenda being enforced with engineering complicity. We may feel one thing or the other, but only an independent audit can verify the numbers.

The NAB/NPR partnership’s audacity in making a Congressional end run around the FCC’s licensing powers is the most interesting. There were always channel interference problems, but there were always a financial incentive for the FCC to implement a political standard. This was even more true when there were no subcarriers — but at least the decisions were made and we moved on.

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The cynical might say that because the channels are still legitimately in use by analog TV broadcasters, why should these wireless companies pony up the cash until they can use the spectrum. Or, even more cynically, one might wonder if the expected $2.6 billion of revenues already included in the appropriations bill for the government’s financial year is actually the issue. Delaying the auctions until September with a financial year completed at the end of September is an interesting embarrassment to Congress.

The largest of the “battle of the engineers” is 8VSB and COFDM. Do we have genuine technical issues that show one is better than the other across the board, do we have implementation delay tactics, or do we have political pressure? There have been direct accusations of the manipulation of data to suit the agenda of the companies involved. This is an accusation that involves engineers as willing partners in crime.

Sinclair advocates COFDM. CBS advocates 8VSB. NBC abandoned its own plans for tests and is helping Maximum Service TV (MSTV) conduct tests, and PBS appears to be a part of that picture. Advice is coming from all over the place with countries like Brazil doing its own testing. Anatel—Brazil’s equivalent of the FCC— is favoring 4k COFDM, but the difficulties that it found with 8VSB “might be difficult to quantify in tables.”

With the ATSC also involved in the MSTV testing, the FCC is rather out on a limb again with its very clear agenda to press ahead with DTV implementation. Despite the delay in the 700MHz auctions, the FCC knows that extensive delays in selling UHF spectrum will not be tolerated by Congress for very long. One way or another, those stations that are roadblocks in that to-be-sold space will go off the air. Torn between a national budget that politically has to be positive and a few small TV stations, there will be no choice.

In the face of these political realities, perhaps it’s time for the engineers to come out of the sand box, and go back to a place where technical accuracy, rather than playground games, rule the day.

We seem to have entered a world where engineering has become opinionated, perhaps colored, by financial or political interests.

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