BROADCAST ENGINEERING

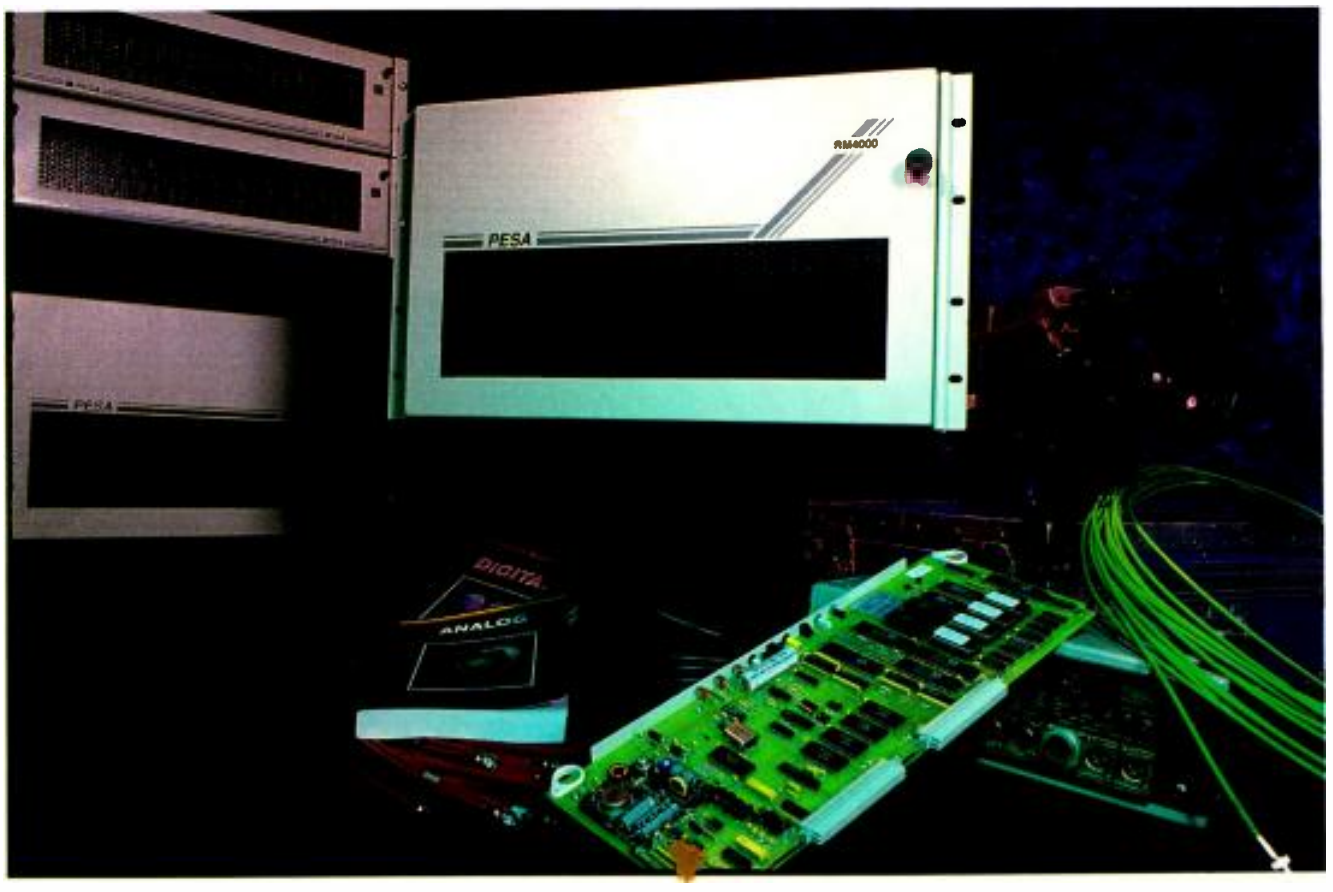
AN INTERTEC PUBLICATION

January 1993/$4.50

Remote production special report

Buying ENG/SNV vans

Radio: An industry in transition
P. 54



The PESA **RM**4000...*it's a big deal for a little bit.*

...for a little bit. The 48x40 video matrix is a compact 6RUs ...as is the 48x48 stereo audio matrix (96x48 mono). The inherent low cost of PESA's A/V matrices and the new 6600EX plug-in controller...which also "partitions" the matrix for analog, digital or RGB signals...permit the RM4000 to fit tight budgets.

You get a big deal... Extreme flexibility. D2/D3 digital levels, with auto equalization, can be separate or mixed and matched with analog component or composite levels...and added in increments of one input/output without degrading analog paths. The matrix can be "partitioned" to service a small RGB matrix and component video systems...and drive additional matrices. The video matrix can be field expanded to 384x120 (a 96x40 is only 15RUs) and has the identical performance specs and is fully compatible with PESA's System 5, 100MHz system.

A low cost, high performance A/V router for mobiles and small studios.

PESA
Switching Systems
205-883-7370 Fax 205-882-3294
Burbank, CA 800-323-7372
New York City 800-328-1008

Call or Fax to find out how the RM4000 fits your price and performance requirements.

THE PESACHYRON GROUP

PESA CHYRON CMX AURORA

Circle (1) on Reply Card

Don't Get Snowed Under.

Your transmitter failed. Now you're faced with drifting viewers, falling ad revenues, and your problems are snowballing.

It's an avalanche you can prevent with Harris Platinum Series VHF television transmitters.

Their unsurpassed reliability stems from Harris Allied power-block architecture. The solid-state modules operate at low junction temperatures, extending their life. Parallel redundancy ensures that a control failure won't stop your broadcasts cold. And the interchangeable visual and aural power amplifier modules are self-protected against six fault conditions.

Broadcast quality? It's top of the line. Plus, Platinum Series transmitters are available in all international broadcast standards and at power levels from 1Kw to 60 Kw.

Don't chance it with a flaky transmitter. Choose a Harris Platinum Series transmitter. From the company that's building the future of broadcasting.

USA 217-222-8200
FAX 217-224-1439
International 217-222-8290
FAX 217-224-2764
Canada 800-268-6817
FAX 416-764-0729

HARRIS ALLIED

Circle (4) on Reply Card

Contents

January 1993 • Volume 35 • Number 1

BROADCAST engineering

Page 26

Courtesy of Robert Milazzo/ABC

Page 42

Page 48

REMOTE PRODUCTION SPECIAL REPORT:

Remote production is still the toughest and most unique aspect of broadcasting. The process involves all of the elements of in-studio production but adds a host of new and uncontrollable variables. Success often depends more on planning than on execution.

DEPARTMENTS:

ON THE COVER:

Remote production trucks must provide studio-like features and capabilities in a portable package. (Cover credit: Harris Allied Systems.)

FEATURES:

OTHER FEATURES:

It doesn't care *what* your problem is.

Our new generation of Audiocom® intercoms are so versatile, they can adapt to practically any configuration. Wet or dry applications... balanced or unbalanced lines... limited rack space—no problem. Easily expandable, too: standard mic cable connects up to 18 channels with almost any combination of our station, power supply or speaker components.

Other unique features include: voice-activated mics; independent channel Call lights and Talk/Listen controls; true, built-in IFB; and backlit, pressure-sensitive key pads that "latch on" or let go, depending how you press.

See your Telex pro audio dealer or call 1-800-554-0716 for more information.

Audiocom® intercom. So versatile, you'll have to find something besides your intercom system to worry about.

TELEX®

Shown above: the US-2000 two-channel main station (one rack space high, half-space wide).

Circle (5) on Reply Card

News

By Dawn Hightower, senior associate editor

EIA announces digital radio formats

The Electronic Industries Association (EIA) has announced that the following digital radio system proponents responded to a call for detailed system descriptions by the Dec. 15 deadline: AT&T Bell Laboratories, AT&T/Amati Communications, Jerrold Division of General Instrument, NASA/VOA, and Thomson Consumer Electronics (for EUREKA 147/DAB).

The Thomson format proposes testing in the L-band, while the NASA/VOA format is an S-band DBS system. All other formats propose FM in-band interstitial (IBI) or adjacent-channel systems.

Of the 11 proponents originally identified by EIA, only these five remain. Other proponents were given until mid-January to submit system descriptions, with at least one more format expected (possibly an FM-IBI system from MIT and a partner).

Conspicuous by their absence are the in-band, on-channel (IBOC) AM and FM systems from USA Digital Radio. USA Digital declined to participate in the EIA testing at this time, citing uncertainty among broadcasters about the level of broadcast industry participation and potentially premature time frame of the process.

The next phase of EIA's process involves hardware testing. Selection of formats for passage to this phase is expected in early February. Tests will start in mid-April and continue throughout the year. In addition, EIA announced a testing budget of approximately $500,000. EIA will solicit financial and in-kind support from proponents and the broadcast industry. For further information, contact Ralph Justus at 202-457-4900 or Bob Culver at 301-776-4488.

NRTC opens DBS program to affiliate participants

The National Rural Telecommunications Cooperative (NRTC) is accepting applications for participation in the NRTC/Hughes Communications direct broadcast satellite (DBS) program from non-rural utilities. This will allow non-NRTC member organizations, interested investor groups and individuals to join rural electric and rural telephone systems throughout the nation in providing DBS services to rural households.

NRTC and Hughes signed an agreement that allows NRTC members to market DBS programming and low-cost 18-inch satellite dishes to homes in rural service areas (RSAs) and non-cabled metropolitan statistical areas (MSAs).

The agreement callls for Hughes Communications to deliver a complete turnkey DBS capability to project participants.

Hughes Communications will launch the first of two DBS satellites in December 1993. The Hughes DBS satellite will be the first specifically licensed by the FCC to bring television to consumers.

AES calls for papers

The 95th Audio Engineering Society convention committee has announced a call for technical papers to be presented at the 95th AES Convention, "Audio in the Age of Multimedia." The convention will be held Oct. 7-10 at the Jacob Javits Convention Center in New York.

Broadcasters want flexibility for ATV development

The National Association of Broadcasters (NAB) has told the Federal Communications Commission (FCC) that in order to help establish advanced television (ATV) in the United States, broadcasters need more flexibility to choose how much and what types of ATV programming they can present.

At issue is an FCC proposal that requires TV stations to simulcast 100% of future TV programming on both ATV channels (HDTV) and NTSC channels. The FCC wants the simulcasting requirement during the ATV transition period to make sure Americans can watch ATV programming using today's NTSC receivers.

Broadcasters, however, say the simulcast requirements are unnecessary because no one will be denied any broadcast programming. The NAB argued that market forces will ensure all ATV programming is available to viewers equipped with today's TV sets. By using compatible converters built into new NTSC TV sets or inexpensive converter boxes, any television will be able to show ATV programming, though the picture quality will be NTSC.

The additional consumer cost is expected to be $50-$100. The NAB argues this alternative is better than the more rigid simulcasting requirements, which likely will constrain development of ATV markets. To complete the ATV transition, NAB has estimated individual stations must each spend between $12-14 million dollars. ■

BROADCAST engineering

EDITORIAL
Brad Dick, *Editor*
Carl Bentz, *Special Projects Editor*
Skip Pizzi, *Technical Editor*
Dawn Hightower, *Senior Associate Editor*
Stefanie Kure, *Associate Editor*
Tom Cook, *Senior Managing Editor*
Pat Blanton, *Directory Editor*

ART
Nenita Gumangan, *Graphic Designer*

BUSINESS
R.J. Hancock, *President*
Cameron Bishop, *Group Vice President*
Duane Hefner, *Group Publisher*
Tom Brick, *Marketing Director*
Czatdana Inan, *Group Director, Special Projects*
Evelyn Hornaday, *Promotions Manager*
Sandra Tomczak, *Promotions Coordinator*
Dee Unger, *Advertising Business Manager*
Mary Birnbaum, *Advertising Production Supervisor*
Shelly Larkey, *Advertising Coordinator*
Stephanie K. Carlson, *Classified Advertising Coordinator*
Lori Christie, *List Rental Sales*
Doug Coonrod, *Corporate Art Director*
Carol Sharp, *Circulation Director*
Customer Service: 913-967-1711

TECHNICAL CONSULTANTS
Eric Neil Angevine, *Broadcast Acoustics*
John H. Battison, *Antennas/Radiation*
Dennis Ciapura, *Radio Technology*
Dane E. Ericksen, *P.E., Systems Design*
John Kean, *Subcarrier Technology*
Donald L. Markley, *Transmission Facilities*
Harry C. Martin, *Legal*
Curtis Chan, *Audio/Video Technology*

MEMBER ORGANIZATIONS
Sustaining Members of:
- Acoustical Society of America
- Society of Broadcast Engineers
- Society of Motion Picture and TV Engineers

Member,
Association of Business Publishers

Member,
Business Publications
Audit of Circulation

BROADCAST ENGINEERING is edited for corporate management, engineers/technicians and other station management personnel at commercial and educational radio and TV stations, teleproduction studios, recording studios, CATV and CCTV facilities and government agencies. Qualified persons include consulting engineers and dealer/distributors of broadcast equipment.

BROADCAST ENGINEERING (ISSN 0007-1994) is published monthly (plus three special issues) and mailed free to qualified persons within the United States and Canada in occupations described above. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address changes to **Broadcast Engineering**, P.O. Box 12960, Overland Park, KS 66282-2960.

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

CORRESPONDENCE
Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2215. Telephone: 913-341-1300; Editorial fax: 913-967-1905. Advertising fax: 913-967-1904.

INTERTEC PUBLISHING CORPORATION

Nikon ENG/EFP lenses. All you need to look good.

When you're on location with a CCD camera reaching for the best shot possible, you need ENG/EFP lenses that are compact, lightweight, and easy to maneuver. Lenses with the flexibility to adapt to any situation. Lenses with all the star qualities found only in a Nikon.

Our ENG/EFP precision lenses are created from the same superior glass and coating technology that have made Nikon the world renowned name in optics. Which means they're made with Nikon's exclusive Extra-Low Dispersion (ED) glass. And treated with special anti-reflection coatings to minimize ghosts and flare. Plus, their strong magnesium housing makes them extremely durable. So no matter how tough the assignment, Nikon ENG/EFP lenses are even tougher.

Our full line of outstanding ENG/EFP lenses includes the Nikon S9x5.5 wide angle lens — perfect for tight, close-up shots. The Nikon S19x8, with its unsurpassed focal length and range. The all-purpose Nikon S15x8.5. And the economical Nikon S13x9.

Want to create special effects with your CCD camera? We have two ENG/EFP converters that will allow you to use your whole bag of Nikkor 35mm SLR lenses. One lets you use wide angle lenses down to an effective focal length of 2 mm. The other lets you use long focal lenses out to 1200 mm.

And in the unlikely event something should happen to your Nikon lens, a simple call to our Nikon Express Loaner Service hotline will get you a loaner lens overnight. So you don't ever have to worry about a crew being out of action until you can get a lens repaired.

To learn more about how Nikon ENG/EFP lenses can make you look good, call 800-52-NIKON or (516) 547-4355 for our complete brochure. Or write: Nikon Electronic Imaging, Dept.D1, 101 Cleveland Avenue, Bayshore, NY 11706.

Nikon EXPRESS LOANER SERVICE

Nikon®
ELECTRONIC IMAGING

r e c r e a t i v i t y

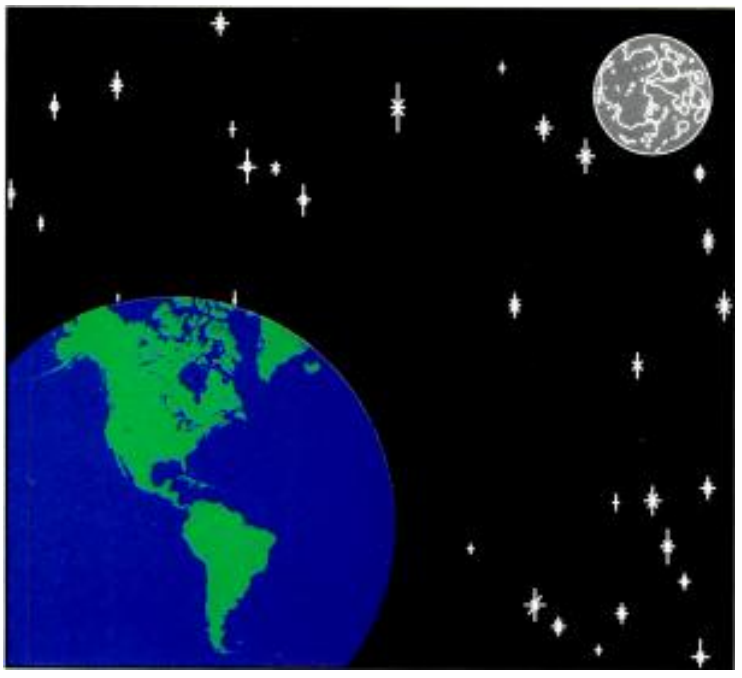
Circle (6) on Reply Card

Editorial

Tithing Mother Earth

As engineers, technologists and managers, we spend a significant amount of time in designing and developing systems, devices and facilities to produce programming. Although we may not think of our industry as having a harmful environmental impact, it is an industry. Like any other industry, it consumes resources and generates waste. Whenever such processes take place, there are ways to reduce them, thus minimizing the collective impact upon the environment.

Therefore, we present a concept, applicable to all technological pursuits: the *environmental tithe.* Using the familiar sliding-scale model adopted by many religious congregations and other membership groups, consider setting aside 10% of every project's design budget to environmental concerns. These efforts could be expended on finding ways to improve the energy efficiency of the project, to reduce its waste or to incorporate recycling.



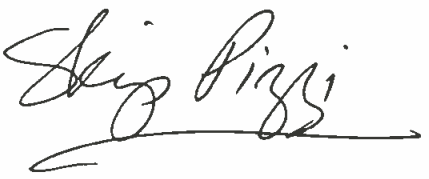
For example, in facility design, could passive solar energy be used for heating? Is the ventilation system designed for maximum efficiency? Is natural lighting used to maxim benefit? Could waste heat produced by a subsystem be rechanneled for other uses? How can fluorocarbon emissions be minimized? Can "smart-design" auto-sensing controls and timers, such as programmable thermostats, be included to maximize efficiency?

Don't stop with operating parameters. Durability also should be considered. Having to replace something prematurely takes up additional resources, both financial and natural.

These issues rarely operate in isolation, however. They often involve compromises in other areas. For example, although a system's reliability shouldn't be sacrificed for a reduction in its power consumption, it may be possible to trade off that last thousandth of a percent distortion for several percent higher operating efficiency. These overlapping trade-offs may become so complex that they can take up considerable design time. In such cases, some of these tithed resources are best spent on consulting with environmental design specialists.

This is not only the right thing to do, but it makes good economic sense. Many dollars are saved each year by operations that have considered environmental issues in their new designs and retrofits.

The environmental tithe is an idea whose time has come. Let's just hope that converts to this belief system see the light before it's too late.



Skip Pizzi,
technical editor

PURE DIGITAL.

NAB BROADCAST 1991

Use the 8200's Automatic Preset Switching to automatically change the processing on a programmed schedule. Ideal for dayparting or multi-format stations.

Bottom Line Orientation.

Creating a "sound" that attracts and holds the largest possible audience is the bottom line in the radio business. And the new OPTIMOD-FM Digital 8200 is a technological breakthrough with bottom line impact.

Digital Makes the Best Even Better.

The power of digital propels the 8200 to new levels of performance and functionality. OPTIMOD-FM 8200 is a *true* digital audio processor—the audio is digitized and all control functions are digital.

What is the value of digital processing and control? In addition to a better sound, digital makes the OPTIMOD-FM more user-friendly, more programmable, more flexible. Simply put, because the OPTIMOD-FM is easier to adapt to a station's programming needs, it will produce more benefit, more of the time.

OPTIMOD-FM DIGITAL

The Processor with Multiple Personalities.

With most conventional processors, multiple processing configurations require multiple boxes. With the 8200's Multiple Variable Processing (MVP) architecture, processing configurations can be changed with the push of a button—select the protection MVP for total transparency, or the two-band MVP for an improved version of the traditional open, bright and natural OPTIMOD-FM sound which helped make thousands of stations successful. Choose the optional multi-band MVP and meet the challenge of competitive major-market processing with selectable speeds to match any format.

Power. Potential. Profitability.

Take advantage of the power, potential and profitability of the OPTIMOD-FM 8200. Call your dealer now for a personal, hands-on evaluation of the 8200.

The OPTIMOD-FM 8200 is a technological breakthrough with bottom line impact. The power of OPTIMOD— in pure digital.

orban

A Division of AKG Acoustics, Inc.
1525 Alvarado Street
San Leandro, CA 94577 USA
Tel: (1) 415/351-3500
Fax: (1) 415/351-0500

Circle (7) on Reply Card

FCC Update

ANSI RF guidelines are reviewed

By Harry C. Martin

By March or April 1993, the FCC is expected to initiate a rulemaking or inquiry proceeding to revise its guidelines for assessing the dangers of RF radiation to humans.

Last year, the IEEE submitted revised RF standards to the American National Standards Institute (ANSI). ANSI is expected to adopt the standards early this year. This will be the first change in ANSI RF guidelines since they were issued in 1982. The IEEE has separately proposed standards for measuring RF radiation in hazardous, close-in situations. Those standards are being considered by ANSI.

The proposed standards are based on data from the latest studies on the dangers of RF radiation, and include different guidelines for the public and for workers. Copies of IEEE's proposed standards can be obtained by calling IEEE at 800-678-IEEE. The document of the new RF standards is designated IEEE C95.1-1991. The document containing the proposed new RF measurement standards is IEEE C95.3-1991.

In 1986, the FCC began enforcing ANSI's 1982 guidelines in connection with its licensing functions. Because adoption of new standards will require amendments to the commission's rules, it will be necessary for the agency to seek public comment on them through the rulemaking process. If the new standards are adopted, the commission also will revise its current OST Bulletin 65, which explains current FCC RF guidelines.

In addition, the FCC will consider other RF standards that have been issued since the 1982 publication of ANSI's guidelines. Such standards have been promulgated by the National Council on Radio Protection and Measurements and the International Radiation Protection Association.

The FCC is continuing to enforce its existing RF radiation standards. In August, the commission issued a Public Notice reminding licensees of their continuing obligation in this area. Most renewal applicants, after appropriate analysis using ANSI guidelines, can certify that their operations will not have a significant environmental impact. This certification includes a determination that humans will not be exposed to RF radiation in excess of the guidelines. Failure to comply with such representations will be considered a serious matter that may warrant further action, including sanctions.

Martin is a partner with the legal firm of Reddy, Begley & Martin, Washington, DC.

Type acceptance of aural STL facilities

In 1985, the FCC grandfathered non-type-accepted STL/ICR transmitters for a 5-year period ending June 30, 1990. This requirement was adopted to ensure that all STL/ICR transmitters met technical standards and encouraged the production of transmission equipment capable of using narrower bandwidths. At the request of the Society of Broadcast Engineers (SBE), the commission extended the STL/ICR equipment authorization deadline to July 1, 1993.

July 1, 1993 is the deadline by which all aural broadcast STL, ICR and booster stations must be using FCC-authorized equipment.

FCC initiates cable reregulation proceedings

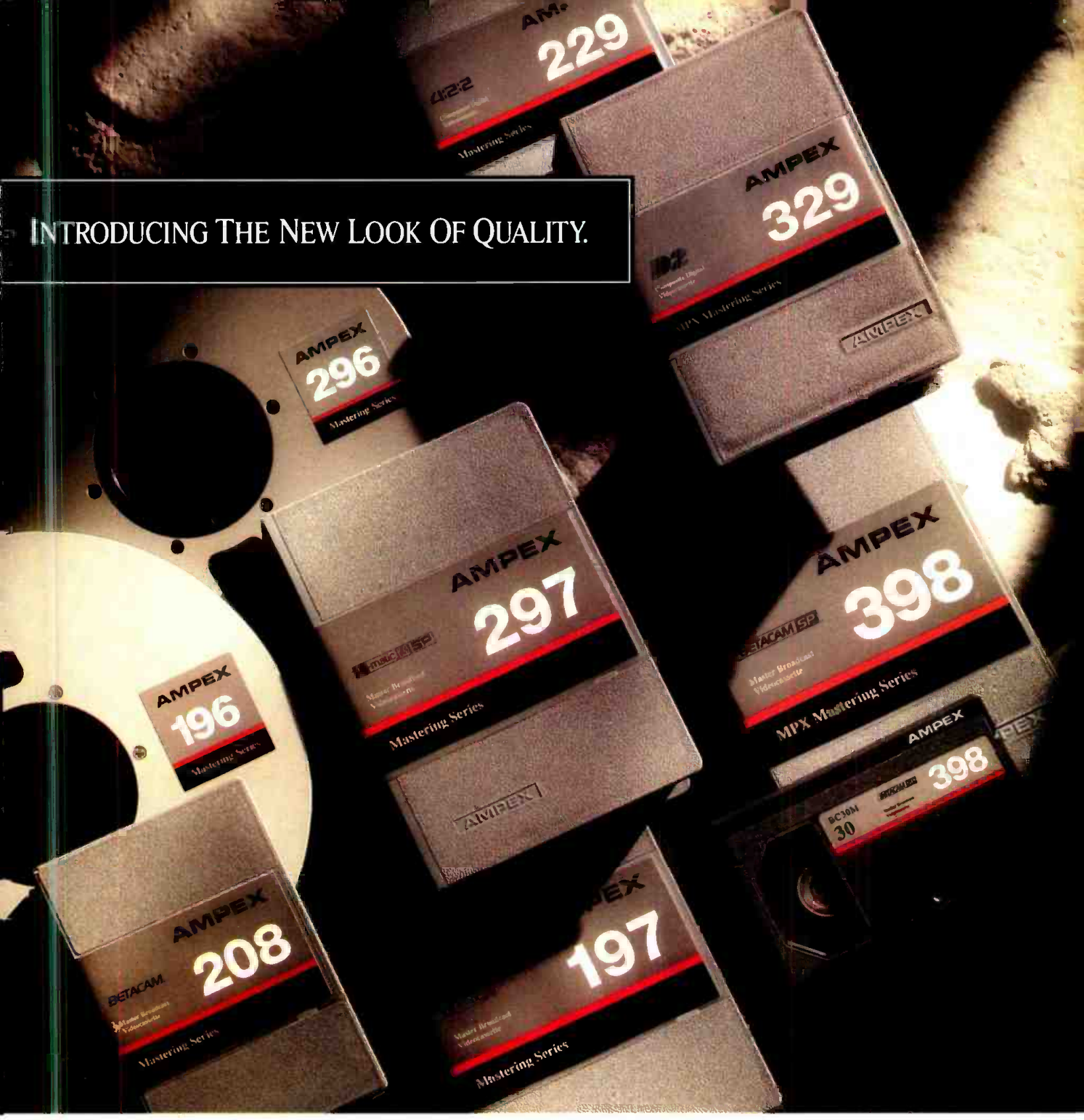
In early November, in response to the Cable Television Consumer Protection and Competition Act of 1992, the commission initiated rulemaking proceedings to adopt rules to implement the 1992 act. The most important proceedings are those dealing with must-carry/retransmission consent and local subscriber rate regulation.

• *Must-carry.* The 1992 act requires cable systems to carry local TV stations and qualified LPTV stations. It also specifies the number of must-carry signals that operators must provide according to the number of their activated channels. Systems with 12 or fewer activated channels must carry the signals of at least three local commercial TV stations and one local non-commercial station. Cable systems with more than 12 usable activated channels must carry the signals of local commercial TV stations, up to one-third of the aggregate number of activated channels. Systems with 13-36 usable channels must carry up to three local non-commercial stations. Systems with more than 36 usable channels must carry all local non-commercial stations. Also, cable operators have the discretion to carry additional TV stations, subject to retransmission consent and certain statutory exceptions relating to LPTV stations and network affiliates. The commission is seeking comments on the implementation and enforcement of these requirements.

• *Retransmission consent.* Under the new law, broadcasters will be allowed to choose whether to invoke their must-carry rights or to negotiate monetary compensation with cable systems for the right to retransmit their signals. Every three years broadcasters will be afforded the opportunity to choose between invoking the must-carry provision or negotiating for retransmission consent.

Short-spacing on FM/DAs eliminated

The commission has reviewed and eliminated its policy regarding the 8km temporary short-spacing limit imposed in 1988, when the commission first allowed short-spacing between FM stations — provided interference protection to such stations could be shown. Under the 1988 rules, interference protection justifying a short-spacing could be provided by the use of a directional antenna, a reduction in operating power or height, or by taking advantage of terrain elevation in the direction of the short-spaced station. The 8km short-spacing limit was intended to reduce the number of applications that were expected to be filed under the commission's then-new interference protection standards. Removal of the limit is now possible because of the staff's increased experience and greater computer capability in dealing with application of the interference protection standards. ■



You're looking at the most comprehensive line of new and improved videotapes in Ampex history.

All the result of the an uncompromising commitment to quality.

We evaluated every aspect of every one of our products against the most rigorous standards of all—those of demanding professionals like you.

That's why we developed new formulations. New backcoats. New basefilms.

That's why we designed new cassette mechanisms. New spools. New plastics.

That's why we refined our manufacturing processes. Incorporated new automated assembly systems. Added new high resolution inspection procedures.

All to give you new levels of performance, quality, and consistency. Dramatically reflected in new colors, new packages, new labels.

But see for yourself. Take a look at our new line of video products—Ampex 398 Betacam SP and 208 Betacam, Ampex 329 D-2 and 229 D-1, Ampex 196 and 296 1" Type C, and Ampex 197 U-matic and 297 U-matic SP.

And see the new look of quality.

AMPEX

Ampex Recording Media Corporation 401 Broadway, M.S. 22-02, Redwood City, CA 94063-3199 (415) 367-3809

Circle (8) on Reply Card

Part 1

Strictly TV

Strictly HDTV

System background

By Curtis Chan

The testing of advanced TV transmission systems vying to become the HDTV broadcast standard began July 12, 1991. The ATTC was created to help support the FCC and its Advisory Committee on advanced TV service. The goal was to help the FCC set the standards as early as this September.

At present, all five systems have been tested, and the results are being compiled at the ATTC. Between Feb. 8-12, a special panel of the Advisory Committee will be formed. It will consist of prominent players in the field of HDTV development who will be chartered to evaluate the test results and make recommendations or draft a document to be submitted to the Advisory Committee. A decision on the recommended system and possibly one or two backup systems is scheduled to be made by Feb. 24.

Five systems compete

The five systems are simulcast HDTV systems, which propose to operate independently of today's NTSC TV service and to use now-vacant TV channels. All of the systems except Narrow MUSE use digital signal processing before and after transmission.

Although each proposed system offers a unique approach to future transmission requirements, each has three common main objectives: interoperability, scalability and extensibility.

This month, we will focus on the Advanced Digital HDTV (AD-HDTV) system developed by ATRC.

The ATRC (NBC, Philips, Thomson, David Sarnoff Research Center and Compression Labs Inc.) AD-HDTV system has been designed with multiple layers, each having a defined function and interface. A layered digital system approach offers many benefits, including flexibility, hardware, modularity, and the availability of simple interfaces for processing, transmission and storage. The system consists of MPEG++ video compression, MUSICAM audio compression, prioritized data transport format and spectrally shaped quadrature amplitude modulation. The two characteristics that differentiate AD-HDTV are its 2-carrier, spectrally shaped transmission technique and a compression system based on internationally standardized protocols.

Chan is a principal of Chan & Associates, Fullerton, CA

Interoperability

According to the ATRC, the AD-HDTV system was designed with interoperability as a primary consideration. This includes interoperability among picture and sound formats, compressed video and audio datastreams, various packet formats and a variety of transmission media. Aside from the benefits of a layered approach, the use of header/descriptors provides much flexibility. For example, the MPEG header/descriptors allow for the specification of various picture formats. Using this approach, the system can provide for rectangular or square pixel formats, interlaced or progressive scan formats and different frame rates, including 60, 59.94, 50, 30, 29.97, 24 and 23.976.

At the picture layer, the nominal 1,440×960, 1,050/2:1/59.94 format has attributes that contribute to interoperability with current American TV standards. The following are some of the major benefits:

- The 59.94 field rate is identical to NTSC, eliminating temporal artifacts and the need for frame synchronization in mixed production and simulcast environments.
- Its 2:1 vertical ratio with 525 video and 2:1 horizontal ratio with CCIR Rec. 601 used in the 525-line D-1 tape recorders offers economical transcoding of mixed environments.
- The 1,050-line scan format with 2:1 vertical ratio allows a 2H deflection system that will be practical and economical for future combination receivers.
- The 1,440×960 and 1,440×810 formats allow storage of a component frame in a single 16Mbit DRAM and are well matched to low-cost memory devices.
- For interoperability with film, the format provides a 1,050/1:1/24 progressive scan format that allows material to be displayed on 72fps displays by 3:1 frame repetition or converted to 60fps by the traditional 3:2 frame repetition techniques. Also, its 1,050/1:1/29.97 progressive scan format allows material delivered in this format to be displayed on 60fps by 2:1 frame repetition or be converted to 72fps by 5:6 frame repetition techniques.

At the compression layer, AD-HDTV contributes to interoperability with a range of computers, multimedia systems, VCRs and other media. The MPEG scheme can be used to compress differing levels of video quality, ranging from 1.5Mb for such applications as teleconferencing to 65,520×65,520 pixel images. Because the MPEG standard only addressed the code word stream that describes pictures, there was room for improvement. The ATRC decided to enhance the MPEG standard. AD-HDTV uses MPEG++, a 2-pass encoding technique. The first pass counts up where all the energy is. The second pass intelligently allocates the bits to where the energy falls. The MPEG++ encoder prioritizes the data into two streams that will modulate separate carriers in transmission. A narrow bandwidth, *high priority* stream carries the most important information needed to reconstruct a viewable picture, and a *standard priority* stream delivers the remaining information.

Challenges and solutions

The ultimate criteria for selecting an American HDTV standard can be categorized into three challenges. The first is *performance*. An HDTV standard must compress high-quality pictures and sound to fit into a standard TV channel and reliably deliver them in a simulcast environment. This means being robust enough to survive noise and high levels of interference from NTSC co-channel stations.

The second challenge is *flexibility*. Innovative uses of video, audio and data in new products and services will require interoperability among different types of delivery media as well as other audio/visual/data intensive environments.

Third is *cost*. An HDTV standard must be economical for broadcasters, alternate media and consumers. ATRC's proposed AD-HDTV standard has addressed these challenges and has taken its place among the finalists. ■

Your problems down. Your profits up. TAS-Total Automation System

- Complete automation system
- Real-time multiple machine control for CGs, Stills, VTRs and Master Control
- Comprehensive cart machine management
- PC DOS-based ethernet system
- Single, stand alone or multichannel applications

UTAH SCIENTIFIC

VISION. VALUE.™

DYNATECH VIDEO GROUP

Utah Scientific –
801 . 575 . 8801
FAX 801 . 575 . 3299

Asia / Pacific –
Hong Kong 852 . 868 . 1993
FAX 852 . 525 . 8297

Europe / Middle East / Africa –
U. K. 44 . 734 . 890 . 111
FAX 44 . 734 . 892 . 022

ALPHA IMAGE ALTA CABLE PRODUCTS CALAWAY COLORGRAPHICS DA VINCI NEWSTAR QUANTA UTAH SCIENTIFIC

Circle (9) on Reply Card

Part 2

re: Radio

Progress toward in-band digital radio

ACT technology

By A.J. Vigil, Ph.D.

Acoustic Charge Transport (ACT) is an integrated circuit innovation using surface acoustic waves (SAWs) to combine charge transfer functions with high-speed analog electronic processing on gallium arsenide (GaAs) in an unconventional way.

Functions that are typically performed serially in standard digital ICs can be accomplished in parallel with ACT. Computations of up to 45 billion multiply and accumulate operations (MACs) per second are therefore possible, all on a single IC. This is far greater than the capacity of any digital signal processor (DSP) or even most supercomputers.

The impact of this capability on electronics systems is significant. For example, ACT can make a military decoy the size of a soft drink can look like an aircraft carrier to a hostile radar system. Furthermore, it can use noise to enable military communication with featureless radio signals. ACT can be used to double or triple the data storage capacity of magnetic disks, and it can provide highly programmable filters for selecting a desired signal from among undesired ones. It is this last feature that could find application in IBOC digital radio broadcast receivers.

How ACT works

Because GaAs is a semiconductor and a piezoelectric material, it allows the integration of high-frequency electronic and acoustic physics. Figure 1 shows a cross-section of the ACT chip. The bottom layer is the non-conductive GaAs substrate. In the center is the GaAs *epitaxial* layer, depleted of free carriers. The top layer of metal electrodes performs the signal generation, injection and sensing operations.

At the left of the top layer are two interleaved, comb-like traces — the *SAW transducer*. One comb is fed by a single resonant RF signal, while the other is grounded. The resulting signal stresses the piezoelectric epitaxial layer, creating a SAW whose frequency is determined by the comb geometry, ranging from 300MHz to 1GHz (nominally 360MHz). Because this SAW will be used as a sampling frequency, the Nyquist theorem dictates that input signal bandwidths can range from 150MHz to 500MHz.

The SAW travels through the transport channel at the speed of sound in GaAs — approximately 2,684m/s. The piezoelectric effect causes *potential wells*, or concentrated electric fields, to travel along with the SAW's mechanical disturbance. These fields next encounter the *input contact*, where the analog input signal is continuously applied. The potential wells traveling under the input contact "absorb" electrons proportional in number (from about 150 to 1,500,000) to the instantaneous amplitude of the signal at the contact when they pass by. The traveling wells now carry *charge packets* that convey a value to the many *tap electrodes* they pass along the remainder of the transport channel. Each electrode senses a packet's relative charge value non-destructively, so packets continue down the transport channel until electrons are finally removed by the *output contact*.

Note that charge packets take time to pass from tap to tap, and thus a delayed multitap structure is inherently created. Note also that although the input signal is classically sampled, it is not classically quantized, because no coded value is assigned to represent a finite amplitude level. Rather, a continuously variable, directly representative (i.e., analog) charge value is carried by each sample. ACT therefore requires no A/D or D/A converters.

The hundreds of programmable taps (or thousands of fixed taps) available on an ACT device are the basis of the chip's parallel processing ability, and can easily operate as a programmable FIR filter. For FM-IBOC digital radio, this filter performs *adaptive interference cancelation*, by which the FM signal is sensed and canceled, leaving the digital signal undisturbed.

Whether an IBOC approach is selected for digital radio broadcasting remains a near-future regulatory decision. ACT is among several key U.S. technologies involved in making one such system a workable and cost-effective reality.

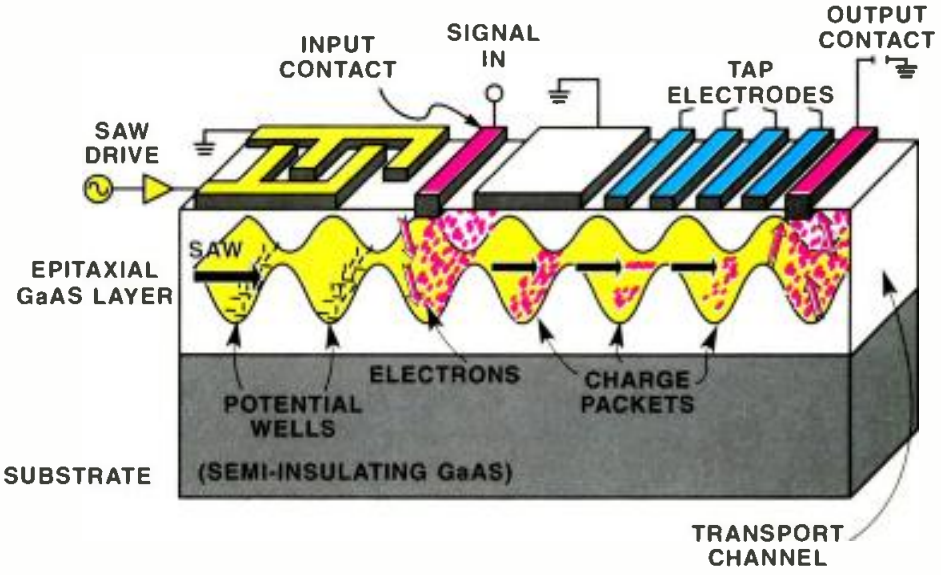


Figure 1. *A cross-section of the ACT device architecture.*

Vigil is an ACT applications engineer for Comlinear Corporation, Urbana, IL.

Editor's note: ACT is an emerging technology with many potential telecommunications applications. Among these is the critical signal extraction function for an FM in-band/on-channel (IBOC-FM) digital radio receiver proposed in the *USA Digital* format. The author is a primary developer of digital radio broadcast applications for ACT.

Acknowledgment: Portions of the development of ACT technology were sponsored by the Defense Advanced Research Projects Agency (DARPA) and Rome Laboratory under Contract F30602-85-C-0170. ■

Have your cake...

You can have it both ways with System One.

Most audio test sets fall into one of two categories...

There are the specialty testers, like tape recorder test sets, video/audio monitors or pricey short interval test systems. Then there are conventional general purpose audio testers, which can do basic testing but lack the capability to fill today's specialized testing needs.

Investing large amounts in specialty systems that don't also meet your day-to-day audio testing needs is both expensive and frustrating.

SYSTEM ONE solves the problem by providing both high performance general purpose audio testing and innovative specialty testing functions. Basic SYSTEM ONE configurations are priced competitively, yet can grow with your needs to include these advanced functions:

FASTest – Test any audio channel in 2 seconds or less

MLS – Quasi-anechoic measurements of loudspeakers

FM – Automated Stereo Proofs

TV BTSC – Automated Stereo Proofs

DUAL DOMAIN TESTING – Direct digital domain testing of digital audio and interfaces.

TAPE TESTING – Complete magnetic tape recorder and media testing.

SPECTRUM ANALYSIS – Audio FFT analysis

EBU 0.33 – Short interval testing

Circle (10) on Reply Card

and eat it too.

With System One, you can have it both ways!

Audio precision

P.O. Box 2209, Beaverton, OR 97075
503/627-0832 1-800/231-7350
FAX: 503/641-8906, TELEX: 283957 AUDIO UR

Part 5

Management for Engineers

Dealing with the difficult employee

The substance abuser

By Judith E. A. Perkinson

It has been said that 10% of a company's employees account for 90% of its personnel problems. A high percentage of the problems from that 10% are related to substance use and abuse. Depending upon the age of the company's work force, opinions about drugs, recreational or otherwise, can vary from righteous indignation to approval. When it comes to alcohol use and abuse, it is more common for people to find ways to justify an individual's abuse of alcohol. For example, we may say:

- Everyone who drinks is not an alcoholic.
- What someone does off the job is his or her own business.
- If I had a wife (or husband) like that, I'd drink, too.
- Work hard — play hard.
- I have been know to overindulge, so who am I to judge?
- Give the guy a break.

Alcohol use is part of our social structure. However, many of us are uncomfortable when it comes to identifying someone as having a problem.

It is difficult to tell when someone has crossed the line between being a social drinker and an alcoholic. Drinking habits often can be tied to family behavior, cultural traditions, peer pressure and sexual identity. Many supervisors are not comfortable passing judgment on an activity that is part of another person's social life. As a result, the problem often goes unaddressed until the working relationship is no longer salvageable.

This does not have to happen, however, because substance abuse is a treatable disease. Research shows that a person who has been successfully treated can return to work as a productive employee. It is good business and smart management to find a way to handle substance-abusing employees.

Develop a substance-abuse policy

It is the responsibility of the station and/or manager to develop a personnel policy that addresses the problems relating to an employee who faces substance abuse. If your station doesn't have an established personnel policy on substance abuse, then the head of the engineering department should address the issue with the administration or establish a policy for the department.

A reasonable policy should contain four elements:

1. *Define substance abuse.* Substance abuse is a disease, which should be acknowledged in the policy.
2. *Treatment options.* The employer should offer an individual an opportunity to be treated for the disease.
3. *Confidentiality.* Every employee has the right to have the problem handled confidentially.
4. *Consequences for lack of treatment.* If the person chooses not to receive treatment or is unsuccessful at treatment, that person should be held up to the disciplinary procedure for any performance or behavioral problems that result from the substance abuse.

Prepare management

Many misunderstandings exist about how to handle an employee with a substance-abuse problem. Supervisors and managers at all levels should be trained to understand the documentation and referral approach to dealing with potential substance abusers.

Documentation and referral

Substance abuse affects a number of job-related areas. The documentation and referral approach to supervisory training prepares the supervisor to use job performance as an indication of a problem. When certain indicators reveal abnormal performance, the person can be told that his work is lacking, and because of this he is being given an opportunity to seek help before disciplinary action. The supervisor can then refer the employee to potential resources within the community for an assessment of the problem. This keeps the supervisor operating within an acceptable area of authority. It also prevents the conflict that results when a supervisor attempts to define the problem and how it should be handled. The indicators used can include:

- Declining work performance.
- Sudden or progressive changes in attendance patterns.
- Increasing absenteeism.
- Fluctuation in work patterns and inconsistent work performance.
- Detrimental behavior, which may include increased conflict with co-workers or supervisors and belligerent behavior.

Identification of resources

Check to see what types of treatment resources are available in the community. A local hospital or mental health center can be helpful. Alcoholics Anonymous chapters are listed in the phone book, and they can identify a variety of substance abuse treatment resources.

Check the company's insurance policy to determine whether treatment is covered by the employee's insurance. This can influence a person's willingness to seek treatment.

What not to do

Understand the potential pitfalls of dealing with a substance-abusing employee. Many problems can be avoided by following these rules:

- *Don't play the expert.* Leave the diagnosis and treatment to a professional.
- *Don't feel guilty.* Substance abusers are good at making other people feel responsible for their problems. A supervisor is not the cause of the problem when he makes the employee face the consequences of his behavior.
- *Don't get emotionally involved.* A supervisor should remain objective, help refer the employee for treatment and make sure there are consequences if the substance abuse is continued.

Problems are not always what they seem

The appearance of the performance indicators does not automatically mean an employee is using drugs. Family problems, health changes and emotions can produce many of the same behavior patterns. It is important that a supervisor not draw any conclusions beyond acknowledging that a problem exists that is affecting the employee's work performance. ■

Perkinson is a senior member of the Calumet Group Inc., Hammond, IN.

Realize up to 50% Energy Savings With AYDIN's High Efficiency Klystron Based Transmitter.

AYDIN Corporation (West), offers a complete transmitter upgrade service that has been proven effective in reducing monthly energy expenses.

These savings result from the use of a new, high efficiency transmitter design utilizing a power klystron. The entire upgrade could pay for itself in less than two years.

AYDIN offers a full service retrofit of present facilities, and has the resources to ensure customer satisfaction.

AYDIN is a Fortune 500 company with a broad product mix. Our complete line of SATCOM High Power Amplifiers complements a full range of high power magnetics and power supplies for broadcasting applications.

Aydin offers a 24 hour customer service hotline to support our customers' late-breaking needs. Call (408) 524-0461 for immediate support.

AYDIN CORPORATION (WEST)

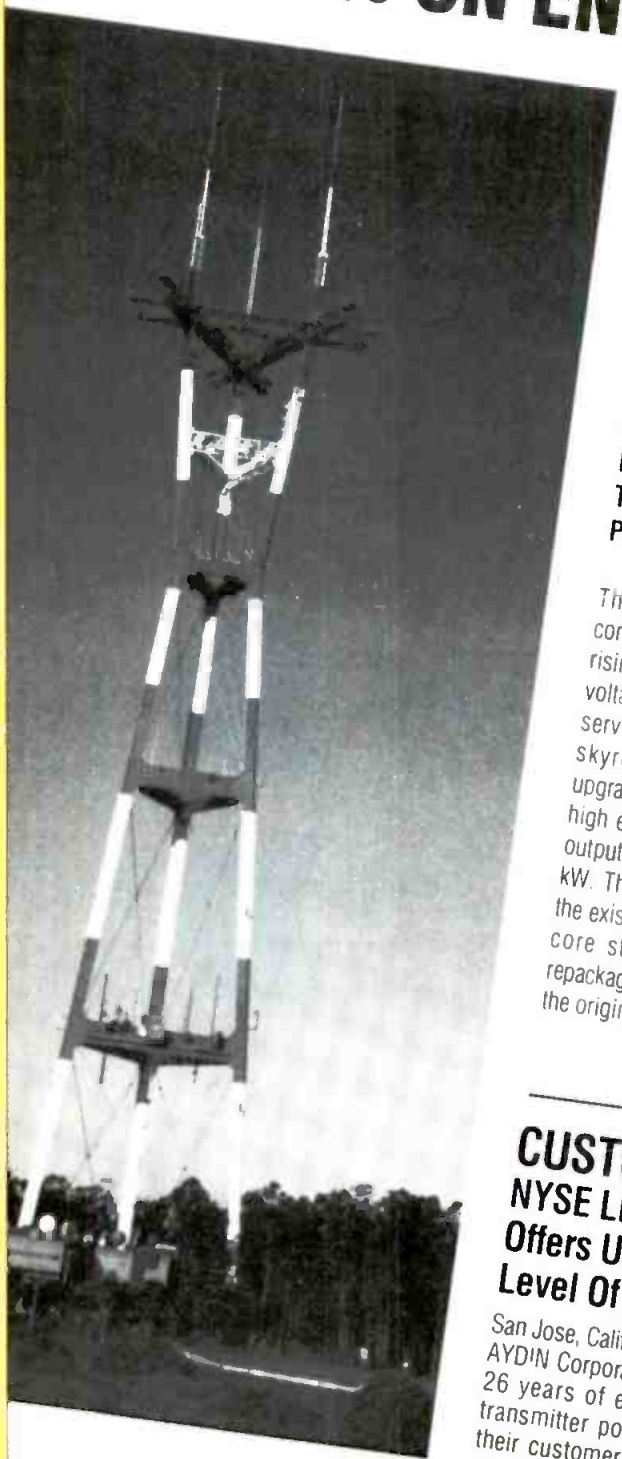
30/32 Great Oaks Blvd.
San Jose, CA 95119-1371
Tel: (408) 629-0100
Fax: (408) 224-4625

Circle (11) on Reply Card

EWS

ECIAL EDITION JANUARY 16, 1993

HOW LOCAL TV STATION SAVES UP TO 50% ON ENERGY COST!



Station Manager Reports.

"$11,000.00 a Month Saved After Installation of AYDIN Transmitter Upgrade!"

Sutro Tower of San Francisco is the Latest Example of The Trend to Utilize The New High Efficiency Tube That Promotes Energy Conservation Efforts.

There is welcome news for all of us concerned with both the environment and the rising cost of electricity. AYDIN's new high voltage power supply and custom installation service provides long awaited relief from skyrocketing electricity bills. You can upgrade your present transmitter with a new high efficiency UHF Power Klystron that has output power levels ranging from 30 to 60 kW. The power supply is designed to fit in the existing tank assembly, reusing the same core steel and rectifiers, or it can be repackaged in a new tank smaller in size than the original.

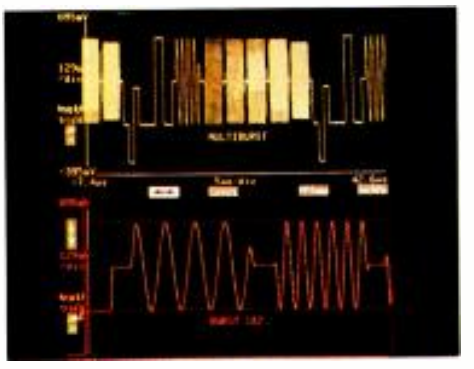
Continued Back Page

CUSTOMER SERVICE: NYSE Listed Firm Offers Unprecedented Level Of Service.

San Jose, California.
AYDIN Corporation (WEST), a company with 26 years of experience in the design of transmitter power supplies, has improved their customer service

Part 5

Troubleshooting



Maintaining telephone systems

Telco line problems

By Steve Church

Sometimes your telephone system's problems are not the fault of the station's equipment, but of the telephone company's lines. When telco line problems are suspected, first verify that the trouble is originating outside of the station's facilities. For that, you'll need to understand a little about the nature of phone lines.

Analog Central Office (CO) lines come in two configurations: *loop-start* and *ground-start*. For a loop-start circuit, the CO provides talk battery to the line at all times, and detects an off-hook condition when current flow is detected across the tip and ring wires. This is the more common arrangement, and is used when no PBX is connected. A ground-start line is often used for business service when the lines are destined for a PBX system. In this case, the CO waits for a connection from the ring wire to ground before connecting talk battery, at which time the user equipment removes the ground connection to establish a balanced talk path. Many PBXs are designed to work with the ground-start circuits because this reduces the possibility of *collision*, which occurs when the phone system tries to seize a line for an outgoing call just as that line is ringing in.

If the service is of the loop-start variety, you can check it with a standard telephone set. Remove the PBX connection by pulling the bridging clips for the suspect line on the punch block nearest to the demarcation point, substitute the standard phone, listen and dial.

Testing ground-start lines is more involved. First, connect the phone set and then use a wire lead to momentarily short the ring wire to ground. This simulates the operation of the PBX. A dial tone should then appear. You probably won't know which of the pair's wires is tip and which is ring, but there is no danger in trying each to find the correct one.

Once the start mode of the line has been established, a VOM can be used to perform a simple voltage check. With no load, a phone line should be at the full telco talk battery level of 48VDC. With a phone attached and off-hook, the voltage can fall to as low as 10V or 12V.

Church is president of Telos Systems, Cleveland, OH.

When working with telco lines, keep in mind this important caveat: ringing causes 90VAC to be present, a value that is painful and potentially hazardous. Take precautions so you don't inadvertently become connected across an active pair.

Ringing causes 90VAC to be present, a value that is painful and potentially hazardous.

Problem? What problem?

So far, we've assumed that the problem line has an obvious defect that your ears and a telephone set are sufficient to detect. In this case, a call to a telephone repair service can result in the reliable correction of the problem. The more subtle degradations — low or widely varying level, unacceptable noise and high distortion — can be evident on the air but may not be revealed with telephone-earpiece listening. These can be more difficult to resolve, because the phone company's technicians generally are not prepared to handle them.

Therefore, it is useful to know something about the causes and effects of various telco conditions in order to help the phone people sort out these subtler problems.

Phone-line noise and distortion go hand-in-hand because both are often the result of too few bits being tickled at some point along the network where analog is turned into digital. As with any digital system, noise and distortion worsen as level declines. The phone company uses only 8-bit resolution, but with an *instantaneous companding* scheme that provides an effective 13-bit performance, or a theoretical 78dB dynamic range. If the voice signal level is low and nears the bottom of this range, distortion can be clearly audible in an on-air situation. The phone technicians must locate the point in the network path where the level is low and make an adjustment to compensate. Alternatively, they may be able to reroute your lines to better equipment.

Another source of distortion comes from the anti-aliasing and reconstruction low-pass filters used in the conversion process. Telephone network specs call for a rolloff of only 33dB for out-of-band signals, corresponding to a distortion level of approximately 3% when audio rich in high frequencies is passed. The effect of this distortion is a sort of "raspy" noise (perhaps with a little tone mixed in) that varies in level along with the speech, such as modulation noise. The sound is unmistakable once you've heard it and had it pointed out. If the problem is caused by the telco reconstruction filters at the digital-to-analog end, they can be helped by adding additional low-pass filtering locally. (This is free with digital hybrids, because the first thing the analog phone-line audio hits is an anti-aliasing filter.) Unfortunately, nothing can be done to eliminate the distortion caused by the aliasing created at the other (analog-to-digital) end.

Noise problems also can be helped with audio processing band-aids, such as *noise gates* and *dynamic noise filters* (DNFs). Use them with care, however. With gates, you risk losing some low-level audio completely, and DNFs can make noise even more subjectively noticeable because of its continually changing level after dynamic filtering. (A DNF works like a frequency-selective gate/expander, and can be used to rolloff high frequencies when signal gets low.)

Noise on phone lines is measured by telco using a weighting filter, called *C-message*. It is designed to simulate the response of a handset earpiece, which has tremendous rolloff at low frequencies. You may have to convince the technician to switch the test gear to the flat position in order to obtain a reading that more closely reflects on-air frequency response.

Given these problems, dealing with the phone company can be frustrating. Unfortunately, although they have every desire to assist, the technicians at "street level" often do not understand the sources of these kinds of trouble. It's sometimes necessary to involve higher-level telco engineering staff, and communicate to them the nature of the problem in a language that they can understand and act upon. ■

OFFICES & ENGINEERING
MARIA MOLINER, 74-76
50007 ZARAGOZA
SPAIN

FACTORY
CMNO. DE LOS ALBARES, 14
CUARTE DE HUERVA
ZARAGOZA - SPAIN

OMB AMERICA
TIB3555 N.W. 79 TH. AVE.
33122 MIAMI FLORIDA
U.S.A.

BROADCAST

Solutions

Engineering by Broadcasting Experts

In OMB you will find the answer for your radio or television transmitting station.

88-108 MHz 5.000 WATTS

Many broadcasters came to us with doubt and went away satisfied, technically and financially.

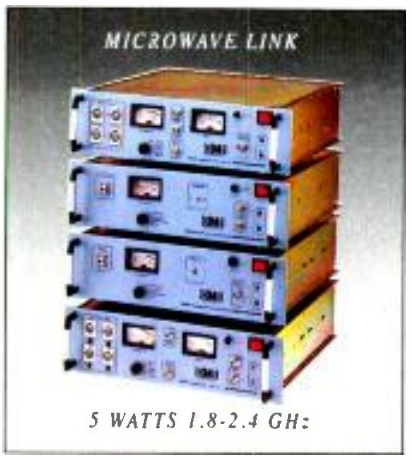
Today we are able to help you.

If you want the best quality and the best value for money OMB can supply them both.

Have confidence in our services.

Facilities:

• System projects • Installation



5 WATTS 1.8-2.4 GHz

• Short delivery time • After sales service • Full technical data

88-108 MHz 500 WATTS

Indicative prices in US$ FOB Zaragoza and Miami

DIGITAL STEREO GENERATOR 45-60 dB SEPARATION	1.375
3 kW RADIATING SYSTEM 4 DIPOLES POWER DIVIDER 1/2" CELLFLEX	2.750
PORTABLE TRANSMITTER 12 V 88-108 MHz 10 WATTS SYNTH	1.550
STL 200-400 MHz 10 WATTS 800-960 MHz 5/6 WATTS TELEMETRY SYNTH uPROCESSOR MONO MPX 2 SCA	4.685
FM TRANSMITTER 88-108 MHz 20 WATTS SYNTH uPROCESSOR	2.475
FM TRANSMITTER SOLID STATE 88-108 MHz 500 WATTS	8.890
FM TRANSMITTER TUBE 3CX1500 88-108 MHz 1.000 WATTS	10.890
FM TRANSMITTER TUBE 4CX3500 88-108 MHz 5.000 WATTS	25.375
TV REPEATER 5 WATTS	6.500
PANEL RADIATOR UHF STAINLESS STEEL	790
MICROWAVE LINK 5 WATTS 1.8-2.4 GHz	15.150

SPAIN
TEL: +34 76 274537 & 37 03 00 FAX: +34 76 37 23 36
TELEX: 57866 OMBZ-E

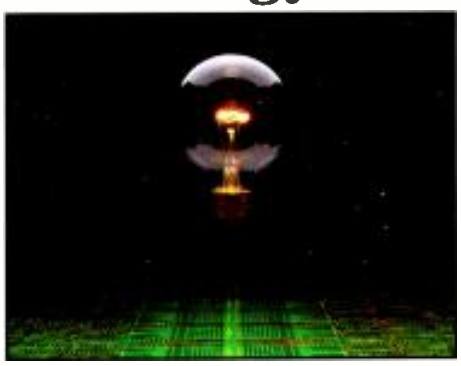
Circle (14) on Reply Card

AMERICA
TEL: +1 305 4770973 & 4
FAX: + 1 305 4770611

TELEPHONE, FAX OR TELEX US NOW

Technology News

Video on demand



By Curtis Chan

Imagine the impact it would have if broadcasters and cable companies could transmit or deliver their programming in less than real time. Consider squeezing 10 TV channels into a 6MHz spectrum. What about squeezing a full-length movie into a few seconds for video-on-demand services? The ideas suggested by Instant Video Technologies may hold the key to these possibilities with a system that electronically distributes (not transmits) and receives an entire audio/video program in a single burst transmission in a fraction of the real time normally taken by the program. At the core of the technology is a 100-200:1 time compression.

Inside the concept

This process begins with A/D converters in an *instant video transceiver* (IVT), leaving the standard audio/video signals in a digital form. The data representing the program is compressed by any appropriate algorithm, including those offered by C-Cube, Intel or UVC, and stored in memory inside the IVT. On demand, the compressed data is transmitted on cable, fiber, high-capacity telephone lines or by satellite in a time-compressed mode to another IVT or *instant video receiver* (IVR). Using fiber, a 2-hour program requires only about 15 seconds for transmission.

An entire program could be stored in the receiving unit. However, for economy, receivers with limited memory could be used. In this case, data is sent in shorter bursts. Before the first segment has been entirely displayed, the next burst is sent.

Various options are possible. The program could be stored in the IVR self-contained storage media and played back at the viewer's convenience, decompressing the signal and reconverting it to analog. With an IVT unit, options include random-access editing, creation of a hard copy, or retransmission of the program in time-compressed mode to another unit.

Advantages

This technology offers a unique function in its time-compressed transmission of video programming because it can grow with other evolving technologies. Data compression and storage techniques, as well as digital communications, can reap the benefits. The encrypted compressed digital format can be used with random-access, error-correcting transmission and applications for computer multimedia presentation. The possibilities do not stop here, however.

For broadcasters, much time is required to exchange syndicated program material, news feeds, commercials and network programming between the independent or affiliated stations. Cost of transmission media and manpower could be reduced when these transfers only require minutes instead of hours. In addition, random-access editing becomes a possibility in compressed-time or real time modes for headends and affiliates. Also, program storage in compressed-time mode greatly reduces the need for videotape, because other storage media can be used.

For cable television, cable companies can deliver true video on demand to customers. The technology permits a wholly electronic means of ad insertion, suggesting an alternative to carts or playback off tape.

In the satellite arena, IV increases satellite functionality so that the cost to the satellite user decreases, but the profit for the satellite broker/owner increases. DBS can become more capable of servicing diverse needs of numerous consumers over a wide area. For viewer convenience, such functions as pause, rewind and stop options can be realized.

Telephone companies operating on high-capacity lines or fiber can implement video-on-demand services. Because programming is sent in short bursts, they are switchable through various network architectures and at varying speeds. Sent in less than real time, there is less probability that the bursts can be intercepted, which provides a degree of copyright security.

Time vs. bandwidth

A more fundamental issue exists for this type of technology to be accepted by the network providers and equipment suppliers. The issue is that the economy will not work in the consumer market at today's costs. However, as the number of available channels and compression levels rise, download time requirements will shrink. Furthermore, as cable systems are rebuilt with fiber nodes serving fewer homes, deployment of IVT technology at intermediate points between homes and headends could cut download times even more.

Time compression offers advantages to bandwidth compression. By downloading to a digital storage device at the end-user's site, the viewer can enjoy VCR-like features unavailable to real time storage. A non-real time compression system suffers less in terms of complexity and cost when faced with incompatible compression schemes.

On demand, the compressed data is transmitted on cable, fiber, high-capacity telephone lines or by satellite in a time-compressed mode to another IVT or IVR.

Technology outlook

Most of the industry focus seems to be on bandwidth compression, which may debut by 1994-95. However, this also gives time-compression proponents more time to make their case. If memory prices are still dropping, higher capacity phone lines are being implemented, higher compression ratios are being sought and a coordinated effort is trying to bring networks, delivery operators and phone companies together, time-compression technology also can expect to have its place in the field of broadcasting.

Chan is a principal of Chan & Associates, Fullerton, CA.

Editor's note: Richard Lang, chairman of Instant Video Technologies Inc., and Michael Pressendo, Hardaway Connections Inc., provided background information for this column. ■

You're looking at the future of affordable digital multitrack.

Today it seems that everyone's jumping on the digital bandwagon. And for good reason. It sounds great, there's no generation loss, and it's state-of-the-art. But until now it's been very expensive—or even inferior.

So when we set out to design the future—we refused to accept anything but the best. And considering that our parent company, TEAC, is the largest manufacturer of professional audio recording and data storage equipment in the world, and was the first company to make multitrack recording affordable, we've got a lot at stake.

That's why TASCAM chose the newer 8mm tape format for digital multitrack recording. It's simply better than anything else. Why? The 8mm transport is the most compact and is designed to take the beatings of the start-stop-start-stop operations that characterize studio and post production environments. And we should know, because TEAC makes transports for both VHS and 8mm. We tried them both. In fact, tests show 8mm to be superior for digital audio multitrack recording. That's just the start. The 8mm format is superior in many ways. Like "Auto Track Finding" (ATF)—an innovative technology that ensures consistent, error-free operation by imbedding important control information during the helical scan. This maintains a perfect relationship between the tracking and program signals on your tape. What does that mean? Precise editing for punching in and out as well as the ability to exchange tapes between musicians and studios without synchronization concerns.

There's more. The Hi-8mm metal particle tape cassette is sturdier and protects the tape against dust and environmental hazards. The 8mm format takes advantage of technologically superior tape that characteristically has a higher coercivity and therefore higher retention than S-VHS tapes. That's why Hi-8 is a preferred format for backup of critical digital data by computer users worldwide. And that's why your recordings will last longer on Hi-8. Even more, with up to 100 minutes of recording time, Hi-8 offers longer recording length than any other format.

We could go on. But the point is that with over 20 years experience, TASCAM has quite an investment in multitrack recording. An investment that has paid off for musicians, recording studios and post production houses worldwide. We've put this experience to work in defining the future of affordable studio quality digital multitrack recording. And you can take advantage of it now.

TASCAM®

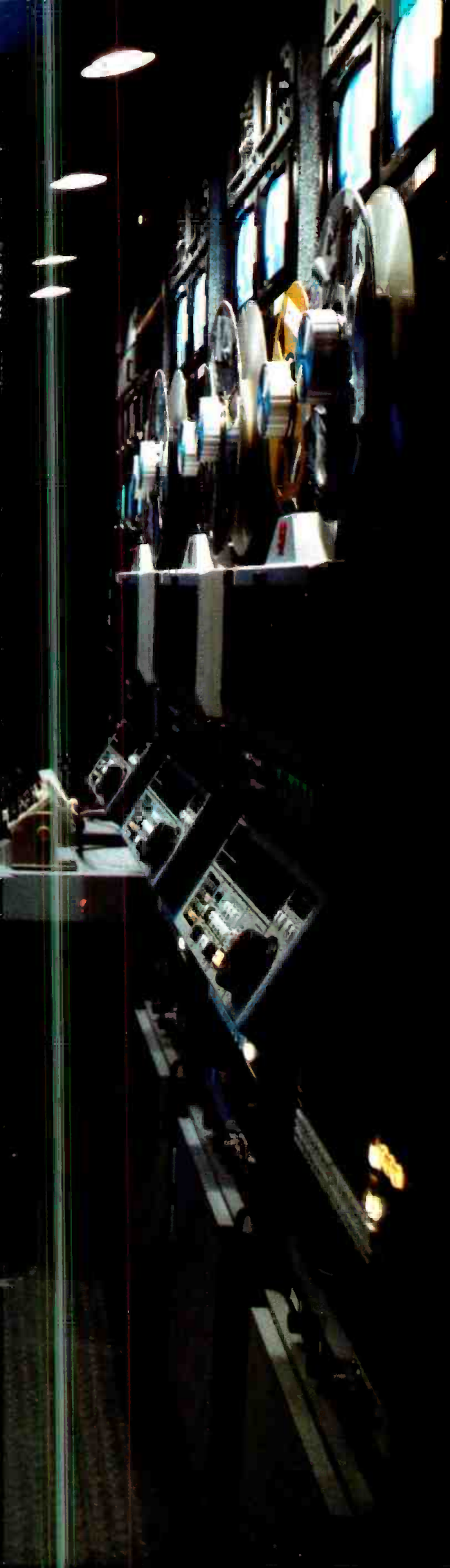
Take advantage of our experience.

For our free booklet, *"Are you ready for Digital Recording?"* write TASCAM, 7733 Telegraph Road, Montebello, CA 90640

Circle (23) on Reply Card

Remote production special report

Remote broadcasts can create profit-generating programming for your audience



It's 12 minutes until air time. Camera 4 still has a cable problem. The noise develops only occasionally, but the crew can't find the cause.

The director is nervous and continues to question the tech director about the satellite feed. There seems to be some snow in it.

Ten minutes away. Everything appears to be working. Tape 2 is recording background material for the half-time show, and the CG operator is updating the scores from other games.

At eight minutes, the network says that a late-breaking news story will delay the broadcast start by 30 seconds. Instead of switching directly from the network sports studio to the remote, net will take your feed after the special report. The director updates the tape operator on the changes.

Four minutes. Everyone is ready. The audio engineer has rechecked the talent mics, and background levels are set.

One minute. Camera 3 from the blimp is steady on the stadium and background audio is on-line.

Thirty seconds. The director tells the talent to standby. Cameras 2 and 4 are holding on their first shots. The announcer watches the line monitor and rechecks his copy.

Five seconds. "Ready camera 3;".... One second, pause. "Take three...and cue announcer."

"From the home of the Kansas City Chiefs, it's NFL football. This is . . . ."

Another live remote broadcast is on the air. To the audience, it's just another football game. But for those who work behind the scenes, each broadcast, location and game has its own challenges.

Sometimes it's the weather. Other times, the challenges are technical. For example, the time a power company accidentally disconnected one leg of the main feeder 30 minutes before air time.

The professionals who staff these broadcasts are unique in their ability to adapt to situations. They've learned to be creative and inventive in terms of solutions.

Another factor in the success of today's broadcasts is the reliability of the equipment. The TV audience expects flawless broadcasts. Such success begins with dependable equipment and designs. This month's feature coverage examines how technology can be used to create profit-generating programming for your audience.

Brad Dick

Brad Dick, editor

GIVE YOUR STATION A BREAK.

One revolutionary machine. A remarkable range of functions, from automated program playback and record to time delay and beyond. The Sony Flexicart™ multicassette system is truly unique – it's compact, format-independent and very affordable. Plus when combined with a Sony LMS providing commercial playback, the Flexicart will help your station break through to a new level of automation. For more information, call 1-800-635-SONY, ext. FLEX.

Buying ENG/SNV vans

Weigh your options before purchasing a remote vehicle.

By Bob King

The Bottom Line

No matter if your station is buying its first remote vehicle, an additional unit or a replacement, it still represents a major investment. The opposing elements of cost and value must be weighed carefully in order for the station to get a truck that suits its needs within an allocated budget. This article will present some practical suggestions to help plan and purchase the best remote production vehicle for your station.

$

Many stations' ENG/SNV truck is the lifeblood of local productions. Remote vehicles are a major investment. If your station is in the market for one, many considerations must be taken into account.

Once the decision has been made to purchase a truck, it is time to determine what type of truck, features and equipment will be required. Although it would be convenient to have every piece of equipment and luxury imaginable, that may be wishful thinking. When listing the important qualities of an ENG/SNV vehicle, these three rules should never be compromised by a budget:

1. The vehicle must be safe, and meet all applicable Department of Transportation (DOT) and federal motor vehicle safety standards (FMVSS) rules.
2. The vehicle must be legal under the gross vehicle weight rating (GVW).
3. The vehicle must last long enough to exceed the amortization schedule.

These rules may seem obvious, but usually they are the most-often forgotten items when a station plans to purchase a remote vehicle.

The basic requirements

First, determine the purpose of the ENG/SNV vehicle. Use the following questions as a guideline:

1. How will it be used 95% of the time?
2. How will it be used the other 5% of the time?
3. What type of equipment will be needed to accomplish the answers to questions 1 and 2?
4. How much redundancy is needed (second largest cost factor)?

As soon as these answers have been determined regarding the size of the truck and the essential equipment, you must:

- Compare different vendors, and check their references, experience and service after delivery.
- Get several different bids based on the truck's intended use.
- Select the best offer based on the final configuration of the remote vehicle.
- Make the purchase.

To ensure the appropriate remote vehicle is built for your facility, ask the following questions:

- What type of standard model should be used?
- What will it cost to make the necessary changes to suit the station's operation?

When shopping for a vendor, attend trade shows, such as NAB or RTNDA, and talk with the vendors.

- Will there be extra costs involved to adapt the station's garage to hold the truck?
- How well does the vendor understand broadcasting and EFP so it can translate the facility's needs into the finished product?
- What type of track record does the manufacturer have?

Picking a vendor

When shopping for a vendor, attend trade shows, such as NAB or RTNDA, and talk with the vendors. Do some comparison shopping. Visit with other stations that have remote vehicles and compare your requirements with theirs. Don't let a ve-

King is vice president of sales and marketing for BAF Communications Corporation, Peabody, MA.

WE DO IT YOUR WAY

DIGITAL

Model 5860D Waveform Monitor and Model 411D Sync/Test Generator handle both serial and parallel digital signals in the D2/D3 format. The generator supplies AES/EBU digital audio as well as a combination color bar/ramp for testing digital systems.

COMPONENT

HDTV

Model 5100 four-channel component/composite Waveform Monitor operates in Betacam, MII, HDTV, and SMPTE formats, as well as analog. Model 425 Generator supplies RGB, Betacam or MII in 3 and 2-wire (Y/CTDM) form, and analog.

COMPOSITE

Model 5870 Waveform/Vector/SCH Monitor shown sharing a half-rack adapter with the Model 5130 Picture Monitor. The Model 411 Sync/Test Generator synthesizes precision analog from a 10 bit D/A.

Call Toll Free

1 800 645-5104

In NY, 516 231-6900

LEADER

FOR PROFESSIONALS WHO KNOW THE DIFFERENCE

Leader Instruments Corporation

380 Oser Avenue, Hauppauge, New York 11788

Regional Offices: Chicago, Dallas, Los Angeles, Atlanta

In Canada call Omnitronix Ltd., 416 828-6221

Circle (15) on reply card for product information only
Circle (16) on reply card for product information & demonstration

hicle's paint job dazzle you. Look in, under, around and on top of the truck with a critical eye. Look at the construction methods. What kind of materials were used? Check for metal shavings, sharp edges, loose wiring, weak materials or any examples of shoddy construction. Cosmetics mean nothing if what's underneath isn't sound.

Manufacturers of remote vehicles in the United States are liable under the law when they put a new truck out with their identification tag attached to it. When selecting a vendor, be sure the remote vehicle is safe, legal and ruggedly built.

Defining the package

Manufacturers of remote broadcast vehicles know the strengths and weaknesses of a particular chassis for specific broadcast applications. For example, GM and Ford use a Uni-Body-type construction that makes the framework of the body, and sometimes the actual chassis frame, integral to the total structure. Whenever a hole is cut into it, the structure is compromised.

For example, if you're buying an ENG/SNV vehicle that uses a Ford E-350, there's not much that can be done to the body without voiding the warranty. Most likely, the manufacturer is aware of the limitations, but the station may not be.

When selecting a vendor, be sure the remote vehicle is safe, legal and built to last several years.

No openings should be cut through the body structure. All openings should be reinforced with steel once cut. Roof air-conditioner mounting holes, the I/O panels, and the generator compartment door should be reinforced to support what is being placed in the hole, no matter how light it is.

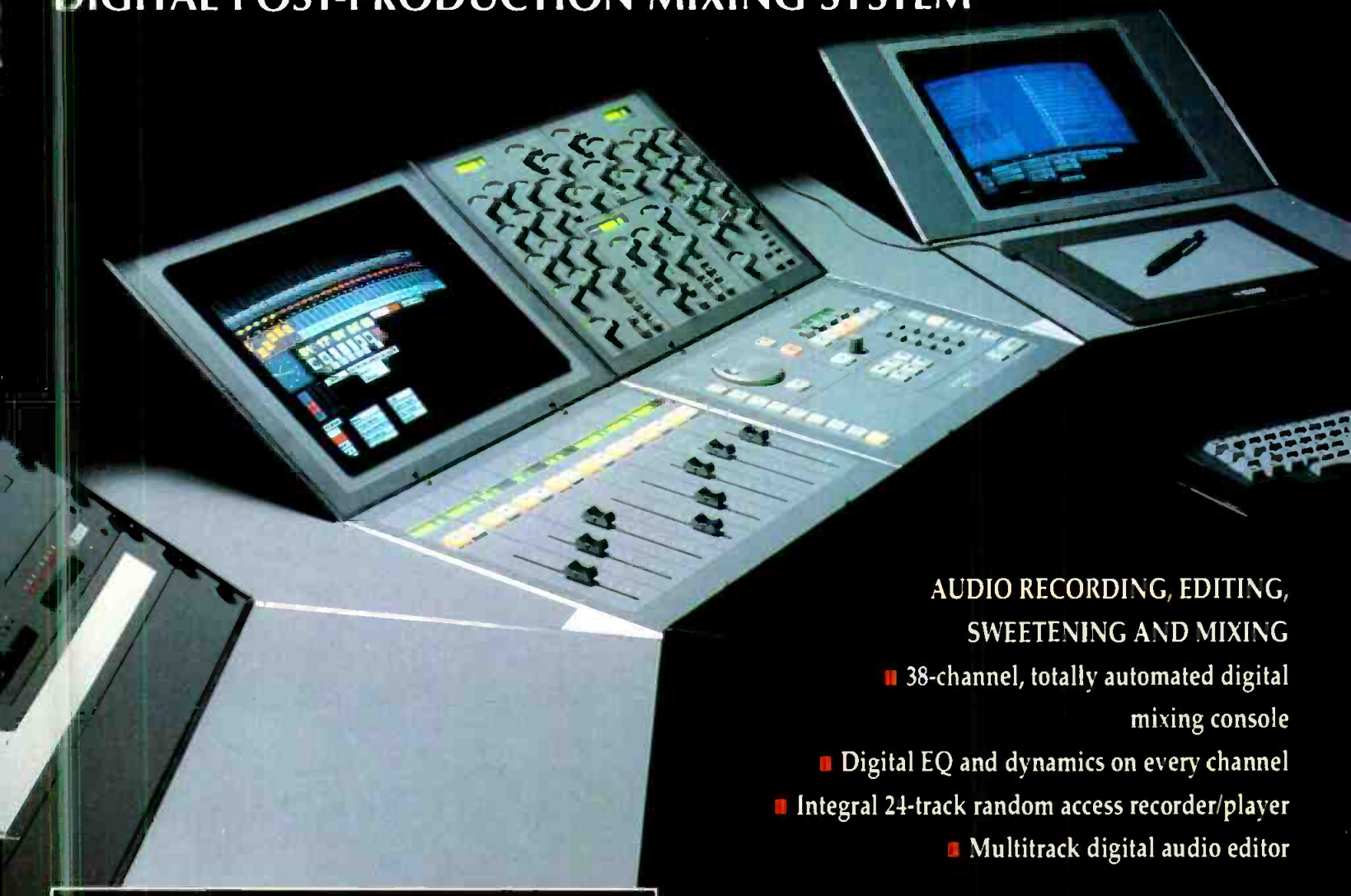
Today, most large remote and satellite vehicles use modular construction. The body is often a framework of square aluminum tubes either welded or riveted into a framework. The aluminum skin is attached by welding or rivets, although the majority of SNV bodies are welded. When manufacturers construct a truck, their goal is to make it last a long time with low maintenance.

The first trucks were made with electronic parts that weren't necessarily meant to bounce down the road. Today, most remote vehicles are more ruggedly built.

Announcing SSL's

Scenaria

DIGITAL POST-PRODUCTION MIXING SYSTEM



AUDIO RECORDING, EDITING, SWEETENING AND MIXING

- 38-channel, totally automated digital mixing console
- Digital EQ and dynamics on every channel
- Integral 24-track random access recorder/player
- Multitrack digital audio editor

RANDOM ACCESS VIDEO STORAGE

- Integral VisionTrack™ system

CONTROL OF EXTERNAL DEVICES

- Multiple ATR/VTR machine controller
- Automated audio/control routing

SYSTEM COMPATIBILITY

- Fully compatible with ScreenSound™ and SoundNet™
- Projects transfer to and from ScreenSound
- Multi-user networking capability

Solid State Logic

International Headquarters:

Begbroke, Oxford, England OX5 1RU · Tel: (0865) 842300

Paris (1) 34 60 46 66 · Milan (2) 612 17 20 · Darmstadt (6151) 93 86 40

Tokyo (3) 54 74 11 44 · New York (212) 315 1111 · Los Angeles (213) 463 4444

US Toll Free: 800-343 0101

Circle (18) on Reply Card

Scenaria

SSL DIGITAL

The three rules of safety, legality and endurance are even more important with regard to a vehicle that must carry much more weight and equipment. Satellite and large remote vehicles typically weigh just under 25,000 pounds.

The DOT has a new set of rules for drivers of vehicles weighing more than 10,000 pounds. It's a good idea to request a copy from your local driver's license bureau.

Courtesy of Southwestern Bell

The Statehouse Convention Center in Little Rock, AR, was the termination point for more than 1,000 telephone, video and data lines. Southwestern Bell provided 115 pay phones for the media on election night.

Don't purchase a lightweight truck just to keep your drivers from having to get a commercial driver's license (CDL). It is in the station's best interest to have a licensed driver responsible for the ENG/SNV truck.

Consider the following when looking for a strong body:

1. Construction technique.
2. Thickness and alloy of wall tubes and skin.
3. Framework construction.
4. Antenna support structure (for SNVs).
5. Belly bunker structure and support.
6. Hardware on what may be used most (i.e., doors).
7. Rack structure.
8. What will it cost to lift the box off and put it on a new chassis?

With so many remote vehicles on the road today, choosing a vendor and obtaining references can help your company make a decision. The strength of the body is important to the longevity of the truck, just as the longevity of the vendor is important to the long-term success of your purchase decision.

The electrical system

The electrical system is the nerve center of the truck and should be heavy duty from start to finish. It should have a high-output alternator, deep cycle batteries and AC-to-DC charging. All wiring should be clearly marked with its label printed on the jacket every several inches. Make sure the wiring is encased in poly conduit or is liquid-tight. Furthermore, make sure that there are marine breakers and battery monitoring, panel indicator lights for critical devices and versatile transfer switching. The truck should not develop any weak electrical spots after just a few years of use.

In order to ensure the electrical system will withstand much use and abuse, look for:

- complete diagrams and documentation.
- quality of construction techniques.
- wire size, marking, binding, channeling and panel wiring.
- component capacities and headroom.

It also is important to choose a vendor that will build a truck that could withstand a few engine and transmission replacements, if needed.

If a diesel engine is chosen, vehicle maintenance may be reduced and it may get twice the mileage. Small diesel generators are available, so mixed fuels should not be a problem.

The SNV RF system

On paper, there is no mystery to the RF system. However, in execution, considerable difference exists. The integrity of the waveguide and control systems is critical to the short- and long-term viability of the truck. The waveguide system should come with a guarantee and performance data that includes actual loss figures. The waveguide and support bracketry should be routed so that the fewest lossy elbows and flanges are used. Be sure it's installed in such a way to prevent accidental "detuning" during service or installation of other equipment.

Don't purchase a lightweight truck just to keep your drivers from having to get a commercial driver's license (CDL).

The vendor should provide a basic training program on the truck. It should include theory and hands-on operation and typical troubleshooting. The HPA manufacturers offer training schools, usually for the cost of transportation and expenses to their facilities. Those programs can be well worth the expense.

To purchase or to build?

Building a remote vehicle in-house

One of the rare times when reality exceeds expectations...

Proven High Power UHF Tetrode Transmitters!

Acrodyne, the pioneer in tetrode technology, has **delivered** the **only** 30kW single tetrode UHF TV transmitters in the world. Consider the following:

- Plant efficiency—cuts cost 50-60%—**Proven**
- Tube life 24,000 hours—**Proven**
- Price advantage—**Proven**
- Less precorrection needed—**Proven**
- Tube operating voltage less than 10kV—**Fact**
- Smaller footprint—**Fact**
- Low cost tetrode replacement—**Fact**
- No diplexer—**Fact**

The proof is in; the facts are undeniable. Models are available from 5kW to 60kW. Talk to **Acrodyne**...the leader in UHF tetrode technology for 25 years.

Tomorrow's digital TV transmitter company.

ACRODYNE

Acrodyne Industries, Inc.
516 Township Line Road
Blue Bell, PA 19422
800-523-2596 or
(215) 542-7000
FAX: (215) 540-5837

Circle (20) on Reply Card

The electrical system is the nerve center of the truck and should be heavy duty from start to finish.

The waveguide system should come with a guarantee and performance data that includes actual loss figures.

should only be done as a last resort. It can cost more than the amount that was budgeted, and could violate safety, legal and endurance rules. You may be money ahead if you shop around for a remote vehicle from a qualified manufacturer.

If your station already owns a remote vehicle, the engineering department should make a list of all the problems with the last vehicle. Knowing about problems with the current truck will enable you to possibly avoid factors that may have been encountered before. Always keep a maintenance log on the remote vehicle.

The price factor

The price of a remote vehicle is indicative of what's in it. Good equipment is expensive. However, one of the most costly elements of the truck is labor. Manufacturers require special tools, equipment and experienced staff to build these vehicles. To make a good product requires a certain amount of work. That is why remote vehicles are a major investment. If the price seems too good to be true, see whether anything has been left out of the package. "You get what you pay for" holds true for most purchases.

Making the best decision

A well-constructed ENG/SNV truck that is safe, meets all legal standards and that is built to last can be an important part of a station's operation. Before making this important investment, determine exactly the station's requirements and which vendor will best be able to build a truck to meet your needs.

➡ *For more information on remote vehicles, circle Reader Service Number 300.* ■

FULL PERFORMANCE
AMAZING PRICE

from

$18,995

Leitch introduces the STILL FILE Special Edition, a new, low cost version of the popular STILL FILE.

Now you can own America's most popular still store for as little as $18,995.

Call 1-800-231-9673 and ask for more information on the new STILL FILE Special Edition.

$18,995 includes 1500 fields of storage. Compact control panel is optional.

LEITCH

Leitch Incorporated, 920 Corporate Lane, Chesapeake, VA 23320 - Tel: (804) 548-2300 or (800) 231-9673 Fax: (804) 548-4088

Circle (22) on Reply Card

PANASONIC DSP CAMERAS: THERE'S AN EMMY IN EVERY ONE.

Panasonic has the only line of video cameras with the Digital Signal Processing (DSP) technology recognized by the National Academy of Television Arts & Sciences with a 1992 EMMY for Outstanding Achievement in Technical Engineering Development.

Now, every camera operator, from broadcast and teleproduction studios, electronic field production, ENG, and corporate and industrial television shooting environments, can access Panasonic EMMY-winning technology. From the highly advanced AQ-225 studio camera through the production-oriented AQ-20D EFP camera to the new value-packed WV-F500 dockable camera, Panasonic has firmly established its leadership in digital technology and camera design by being the first Company to apply the advantages of DSP to professional video cameras.

Panasonic's DSP technology overcomes analog's imprecision and need for constant adjustment. DSP maintains strict uniformity in RGB signals and ensures that phase and frequency characteristics remain stable regardless of normal temperature changes or aging. For assurance against signal degradation, some Panasonic DSP cameras feature digital outputs and fiber optic connection.

AQ-225 STUDIO CAMERA

Camera set-up with DSP is easy, certain and repeatable. Advanced Digital Signal Processing provides for 2-dimensional cross-color filtering, variable enhancements, high-chroma aperture correction, accurate one-touch digital gamma adjustment and auto knee circuitry.

Panasonic's greatest achievement with advanced DSP technology is not just winning awards; it's making that technology *affordable* to you.

For more information call: 1-800-528-8601 ***(upon request enter code 07)***
One Panasonic Way Secaucus NJ 07094

Panasonic
Broadcast & Television Systems Company

WV-F500

WV-F700

AQ-20D

AQ-11D

Remotes for radio

Choose the proper hardware and backhaul methods for your remotes.

By Skip Pizzi, technical editor

The Bottom Line

Deciding how to get audio back from the remote site and what equipment to take along isn't as simple as it used to be. Today's technology presents many possibilities, but not all of them are appropriate for every remote. These options extend across a wide range of costs, as well. Making the right decisions will affect the remote's sound and its profitability.

$

One of radio's strongest assets traditionally has been its portability — both for the consumer and the producer. In today's increasingly competitive environment, radio stations are well served by playing their strongest hand, and live remote origination of programming is certainly something that radio does best.

Technology and programming options offer many choices for exciting and profitable remotes. Of course, the more choices you have, the more decisions you must make. This article is designed to lay out those options, and help guide you through the decision matrix to the optimum remote arrangements. (See Figure 1.)

Local or long distance

Today's radio remotes can originate from the car lot across the street, the football game across the country or the special event across the ocean. Audio from any of these locations often can be transported live at high quality for surprisingly low cost. However, these costs can vary widely, depending on the specific circumstances involved. Plenty of lead time is essential in any case. Occasionally, alternate routings are available, but sufficient time is required to explore them.

The first question in any remote is *where*. It has a *macro* meaning (Where in the world? Where in town?) and a *micro* meaning (Where at the site is the exact origination point?). The latter is important if telco installation is required.

Another related issue must also be known before the backhaul medium can be chosen. The next question is *how often*, referring to the likelihood of recurring origination from a particular remote site. For example, at frequently used local venues, such as stadiums and nightclubs, it may be more cost-effective to install some sort of permanent telco service, even if the station has a remote pickup unit (RPU).

For the increasingly popular long-distance remotes (e.g., morning jocks at Disney World or a talk show host at the Super Bowl site the week before the game) and for sports backhaul, switched digital telco services are now widely used. Switched-56 (or where available, ISDN) service can provide high-quality audio, in stereo if required, for pennies per minute. Terminal hardware is relatively expensive ($2,500 to $3,500 for each end), but this can be leased from telco in many cases. With repeated use, this hardware can be quickly amortized against the savings in connect charges vs. traditional methods. If a station has an ongoing contract for a local team's backhaul of away games, for example, the known number of remotes for the season can be useful in such analysis.

Billing for these services is similar to plain old telephone service (POTS), with a one-time installation fee and a recurring (monthly) service charge for every location at which service is provided. Connect time is billed by the minute or fraction. The actual price structures in each of these categories (including the costs of long-distance calls) also are similar to POTS fees, with the occasional exception of higher installation charges in some areas.

In addition, radio stations can use service agencies to establish the service path, and thereby obtain the most competitive pricing. These agencies receive commissions from the telcos whose lines they book, and charge no fees to the user. When a long-distance service (LDS) is involved in a Switched-56 path, compatibility between the local telco on each end and the LDS can sometimes become a problem. The service agency can usually

Engineers and Producers Agree On The Versatility, Variety and Dependability of Maxell.

That's Why Over 2,000 Pros Nationwide Use Maxell Exclusively.

It's all on your shoulders. You have to create, enhance, preserve, make it work. So you do what you've done reach for Maxell. Rugged, reliable Maxell tapes for state-of-the-art performance ... punish it, push it to the limit, these superb video and audio tapes just won't quit. Durable Maxell tapes for the glorious sound, the brilliant image and the superior specs you *must* have when your reputation is on the line.

Circle (25) on Reply Card

maxell®

Maxell Corporation of America, 22-08 Route 208, Fair Lawn, NJ 07410, 1-800-533-2836
Canadian Inquiries Please Contact:
Hitachi Denshi, 65 Melford Drive, Scarborough, Ontario, Canada M1B 2G6, 1-416-299-5900

solve this.

For local remotes, switched digital services are not as cost-effective in most cases, although they are still worth exploring. Costs for these services and terminal hardware are frequently revised (usually downward), so check with your telco offices routinely for up-to-date pricing on your applications. In the case of a downtown news bureau feeding an uptown studio location, where many short feeds are required every day, switched digital service may pay off right now, whereas a monthly remote from a concert hall might be cheaper via traditional means.

When working on these calculations, remember that telco switched digital services are *bidirectional*, so return paths for communications and monitoring are included in the cost.

Where switched service is not available or appropriate to the application, dedicated digital telco service may be used. These circuits include T-1 (1.5Mbit/s), fractional T-1 (128kbit/s and up) and DS0 (64kbit/s). They are booked in advance, either temporarily or permanently, like analog program circuits. Unlike analog circuits, however, these are typically provided as bidirectional paths.

A full T-1 (or DS1) circuit is made up of 24 DS0 "slots" of 64kbit/s each. Each slot uses 8kHz sampling with 8-bit resolution. A full T-1 circuit can be used for a digital stereo audio signal without data compression. With state-of-the-art data compression (so-called perceptual coders), a T-1 path can carry six to eight stereo pairs. For fractional T-1 applications, compression allows high-quality (15kHz or 20kHz) mono audio to be carried on two slots (128kbit/s). Commonality of audio between left and right channels of a stereo signal allows some additional efficiency (joint coding), so high-quality stereo can be carried in three slots (192kbit/s).

For Switched-56 applications, an older data-compression system called CCITT G.722 is used, which provides 7.5kHz mono into 56kbit/s (or 64kbit/s).

ISDN service provides two 64kbit/s channels in its basic form. Each channel can be directed to a separate location simultaneously, or they can be combined to provide 128kbit/s to the same location, with the appropriate terminal hardware. Some new devices allow users to spread a single digital stereo audio signal across four or more linked ISDN channels. Therefore, G.722 compression or perceptual coding algorithms might be used interchangeably on ISDN.

For satellite backhaul, these same compression techniques allow narrower channels and VSAT terminals to be used, which reduce start-up and continuity costs.

Enhancing traditional technology

If POTS service must be used for a remote backhaul, frequency extenders can improve the subjective audio quality — significantly in some cases. For live remotes, two to four POTS lines are required at the remote site — the more the better. Frequency extenders come in single-, double- and triple-line varieties. For best results, another separate line is required in each case for communications between the station and the remote site. The single-line units extend only the *low-frequency* response of a POTS line (often not worth the trouble). However, the 2-line units extend the *high-frequency* response to approximately 5kHz, and the 3-line systems stretch it to about 8kHz. The multiline varieties usually add noise reduction as well, so fidelity of the feed is improved over untreated POTS service.

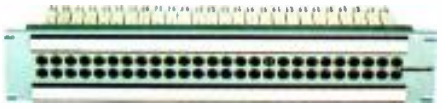
These systems use *complementary* processing, which means that a similar device is required at each end of the POTS lines in encode/decode fashion. Multiline systems require some set-up after the lines

Continued on page 79

Look who's going to improve your image.

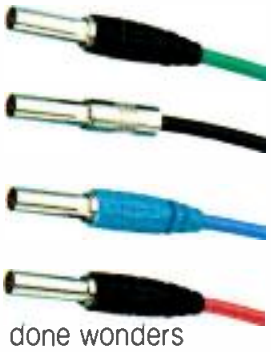
You've heard a lot about Switchcraft, a leading manufacturer of quality audio components for more than 40 years. Now, see what we can do. Because Switchcraft can supply you with video components, too.

Look to us for standard video broadcast equipment, all made with the reliability and high quality you expect from Switchcraft. When it comes to our



video insulated patch panels, you'll find our eye for detail is second to none. Each one can accommodate up to 26 jacks for a variety of requirements. Dual jacks provide a normal-through signal path without the use of looping plugs or patch cords. And, each panel comes with large designation strips for your own labeling.

Our video patch cords are available in popular lengths and colors – all built for efficient video signal transmission. Our patch cords come with rugged metal handles and optional rubber "boots" for a better grip. The "boots" offer enhanced flex relief and are available in your choice of colors – red, black, green or blue. Switchcraft is dedicated to making your studio time as productive as it can be.



So whether you're thinking video or audio components, think Switchcraft. We've always done wonders with sound. Now we can improve your image, too.

For more detailed information, phone or FAX our Marketing Communications Department and ask for New Product Bulletins 426 and 427.

Switchcraft
A **Raytheon** Company

Switchcraft, Inc.
5555 N Elston Avenue
Chicago, Il 60630
(312) 792-2700
(312) 792-2129 (FAX)

Circle (26) on Reply Card

EVER WONDER WHAT HAPPENS TO THE OTHER LAYERS WHEN YOU HAVE TO CHANGE THE 15TH?

Real-time disk recorders were revolutionary when they were introduced. They allowed you, for the first time, to produce multilayered video without picture degradation. And since then, they've spawned a new generation of non-linear real-time editing recorders of great power.

Yet for the original task of multilayering, that first generation of disk recorders is limited to very specific applications. Most can hold only about 1 *minute* of program material, so they're constrained to short elements, such as commercials.

Worse, every layer you create overwrites the previous one. So if your clients change their minds about a particular move in layer 15, for example, and you've already laid down layer 18, you have to start over again... from layer 1.

Starting where the disk stops.

Ampex takes a different approach to multilayering. We looked at how you actually *want* to work in a digital component post-production environment. And while we could have developed a disk-based solution, we chose instead to create a system that goes far *beyond* disk technology.

The result is the Ampex DCT 700d Tape Drive. It can hold 3 *hours* of program material. Which means in multilayering applications every layer you create can be saved intact. So if your clients want to make a change in layer 15, you can do it effortlessly—typically in less than a minute.

The DCT 700d gives you all the creative freedom of a transparent multilayering environment combined with the speed, flexibility, and efficiency of a sophisticated editing tape drive. So when the drive is done with that complex commercial, you can put it to work editing that long documentary. That just can't be done with any other component system currently available, due to the limitations of high cost, high maintenance, and low editability.

In fact, the DCT 700d has been optimized in every detail to meet the demands of post production. It is simply the best digital editing tape drive in the world.

We say that because it is built on the technical foundation of the best *analog* editing tape recorder ever made, the Ampex VPR-3, and the best video signal system, the Ampex Zeus. VPR-3/Zeus is the fastest, gentlest, most accurate, most transparent system ever designed for the analog environment—which may explain why you'll see them in almost every premier post-production house in the world. It truly set the analog recording standard. And now the DCT 700d Tape Drive sets the *digital* recording standard.

The DCT 700d is built for demanding professionals. It is the most advanced tape transport mechanism ever designed. It is precision engineered to maintain ultratight tolerances through the rigors of post production, edit after edit, day after day, year after year.

Yet for all this rugged precision, the DCT 700d is also the *gentlest* drive in the world, floating the tape on frictionless air-lubricated guides and eliminating the pinch roller used on less sophisticated machines. This allows the high performance ballistics to accelerate the tape to 60X play speed in less than one second—without risk to your valuable masters!

If you're used to working in post production, you're used to working fast, and there's no tape drive faster—or more versatile—than the DCT 700d.

Not just a new product, a new perspective.

The DCT 700d, however, is only part of the story.

DCT from Ampex is actually a *system*. A system conceived and optimized for post production in the digital component environment. A system that removes the problems of multigenerational image degradation found in the analog world.

And while each device in the system offers unparalleled performance on its own, when taken together, they offer a post-production solution with a level of precision integration and efficiency never before achieved in this industry.

The Ampex DCT System is also the first complete digital component system available from one manufacturer. In addition to the DCT 700d drive, it includes new tape cartridges, a new production switcher, new computerized edit controllers, ADO® digital special effects, and interconnect equipment.

It is a compact, sophisticated, practical digital component system that unlocks a whole new world of creative–and competitive–possibilities.

Finally, the switcher you want in a size you can use.

Most switchers used in post production today are actually relics from the days of live television, when you needed lots of inputs to handle all the sources.

Digital post-production environments, however, typically require only a few inputs. And you really don't need more than that.

So we looked at how a post-production switcher *should* work in a digital environment and developed the Ampex DCT 700s Production Switcher. It may well be the first sensible digital post-production switcher you've ever seen. Yet you can do as much with it as you can with even the biggest panels.

Why? Because the Ampex DCT 700s has been optimized for post production, and offers you unprecedented transparency with a full 4:2:2 digital component signal system. With two key layer processors, you get unmatched performance, flexibility, and versatility.

The DCT 700s gives you big-switcher performance in a small package. It gives you the freedom to be more creative... and the power to be more competitive.

Tape is tape unless it's this tape.

Some people don't think much about tape. They should.

Whether it's a $30,000 commercial or a $3,000,000 made-for-TV feature, when you lay it down on tape, neither you nor your client can tolerate inferior performance.

And unfortunately, the first time most people think about tape problems is in the last place they can afford them: the edit suite.

That's why we developed the DCT 700t Series Tape Cartridges in parallel with the rest of the DCT System.

And the result you can see for yourself: stunning picture quality.

It's not where you are, it's where you're going.

DCT is the digital component system from Ampex, the company that has been creating video solutions longer than anyone in the world. The company that has been the leader in applying technical innovation to solve practical problems.

That's why DCT *today* is already more than a generation ahead of any other digital component system on the market–or on the drawing board. So while other people keep waiting for the "next" millenium, you can seize all the creative and competitive advantages of this one now.

With DCT from Ampex.

AMPEX
DCT™

Ampex Systems Corporation
401 Broadway, M.S. 3-23, Redwood City, CA 94063-3199

Circle (27) on Reply Card

Planning the mobile unit

What you should know before you start building a remote vehicle.

By Kenneth Hunold

The Bottom Line

The long-form remote TV broadcast requires a special kind of mobile facility. Whether it's a concert, sporting event, awards show or news special, the program's quality will depend greatly on the mobile unit's design and implementation. To maximize the investment in this vehicle, flexibility is a key element in its planning. An experienced remote engineer shares some helpful design ideas on this subject. $

If you're planning a mobile unit for your station, whether it will be large or small, you should think big as you design it. Especially in the early planning stages, the same procedures apply to big and small truck projects. The differences are only matters of scale. In fact, these scale factors make a smaller truck's planning more critical than a larger truck's.

One of the biggest mistakes made when planning a mobile unit is designing it for a specific show or purpose. When the idea for a mobile unit is proposed, there is often a predetermined use for it in mind. Your job should be to take a step back from the project and plan for as many of the what-ifs within the budget of the project. Flexibility should be the paramount criterion when planning a mobile unit. Beware of the perils of designing for the moment.

Many system designers are available to plan a mobile unit. If you choose to use their services, it still helps to understand the processes involved so you can appreciate and evaluate each vendor's methods of providing the facilities you want, and know the trade-offs involved.

How big?

First, decide how large the mobile unit has to be. This is not a simple question, because it depends on every other facet of the mobile unit. Some non-production items to consider include: Who will drive the unit, and what, if any, special operator's license will be required by those who do? Where will you have to park the unit on assignment? Are there any height or weight restrictions at the venues you might be working (low garage doors or tight corners to negotiate)? Where will it be parked when it is not being used? (Will it fit in your garage or will it be parked at the transmitter site?) Is there a place to park it inside for maintenance?

Considering all of these items along with production needs should help to determine the appropriate vehicle size, from the mini-van, motor home or panel truck up to a 30-foot "straight job" or tractor-trailer combination.

How much power?

How much power will be needed is determined by what and how much equipment will be put into the vehicle, including heating ventilation and air conditioning (HVAC). The HVAC system will probably be the biggest consumer of power. It is not just for the operators' comfort, but for the equipment's as well.

In order to determine the amount of current drawn, start by totaling up all of the manufacturer-supplied power requirements of the equipment on the list. Group equipment by function (cameras, tape machine, audio, and so on) so that related groups of equipment can be easily turned off at the breaker panel. Do not exceed 80% of the circuit breaker's capacity for any branch circuit, and don't forget to include a few extra circuits (for the coffee machine added later, perhaps). Also remember that under some conditions, both ends of an HVAC system can be in use at the same time in different areas (for example, providing cooling for the equipment in the tape room and heating for the operators at the switcher).

Equipment selection

The choice of equipment for the remote unit is another key factor in the planning process.

- *Video switcher.* When selecting a video switcher, total up all the video sources you contemplate using and make sure there are enough inputs. It doesn't take long to fill up an 8-input switcher with

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

Which type of CD player is right for your station?

Denon.

With its hugely successful DN-970 and DN-950 CD Cart™ Players, Denon helped make CDs the broadcast media of choice. Given the success of these industry-standard players, there were only two things Denon could do: 1. Make a CD Cart player that is smaller, faster, smarter and better; 2. Make a pro CD player that is *not* a Cart player. Denon did both.

CD-5B CARTRIDGE WITH ATS BAR CODE

The new DN-961FA Drawer-Loading CD Player is Denon's answer to the many broadcasters who *formerly* had to choose between the drawer-type player they needed and the Denon performance they wanted. Its Eject-Lock during play adds another most-wanted feature to its list of attractions. Meanwhile, the new DN-951FA CD Cart™ Player dramatically improved functionality with its Auto Track Select (ATS) system, which reads bar-coded carts to *lock-in, lock-out* or *auto-cue* to a specific track.

That's not all; three-in-a-rack mounting, true instant start, and end-of-message signals with selectable time-to-end are just a few more key features of these cost-effective new players.

The DN-961FA and DN-951FA. Denon just made it twice as easy to decide which CD player is right for you.

DENON
The first name in digital audio.

Denon America, Inc., 222 New Road, Parsippany, New Jersey 07054 (201) 575-7810

Circle (28) on Reply Card

even a small sporting event or live show incorporating taped inserts. Although a *subswitcher* can be used to preselect other switcher inputs, it doesn't make sense to plan on using it regularly. In any case, two subswitchers (and two main switcher inputs to re-enter them with) will be needed in order to mix or wipe between any two sources in the subswitcher.

• *Monitors.* Don't dedicate any control-room monitors to one particular source. Rather, designate a video DA for every switcher input and do all the routing and patching on a *switcher input* basis. Bring all monitor inputs to a patch panel so any feed can be patched to any monitor in the monitor wall. Use the *normal* path of the jack to connect a source to a monitor if you want to set up a standard configuration for the mobile unit, but don't assume that there is any consensus among directors about where everything should be.

Make a blank pictorial diagram of the monitor layout for directors to design the video space they prefer. Specify which monitors are color on the diagram. It is usually sufficient to have two large (13- or 19-inch) color monitors for line and preview. Smaller (9-inch) color monitors are usually chosen for character generators. Monochrome monitors (nine or 13 inch) are generally acceptable elsewhere. Avoid the temptation to put color monitors throughout the monitor wall. It is not worth the expense or difficulty in color-matching all those monitors for the few times it will help to find "the red hat."

Video control room of a mobile production unit.

Production control room of a mobile unit, configured for ABC's Monday Night Football.

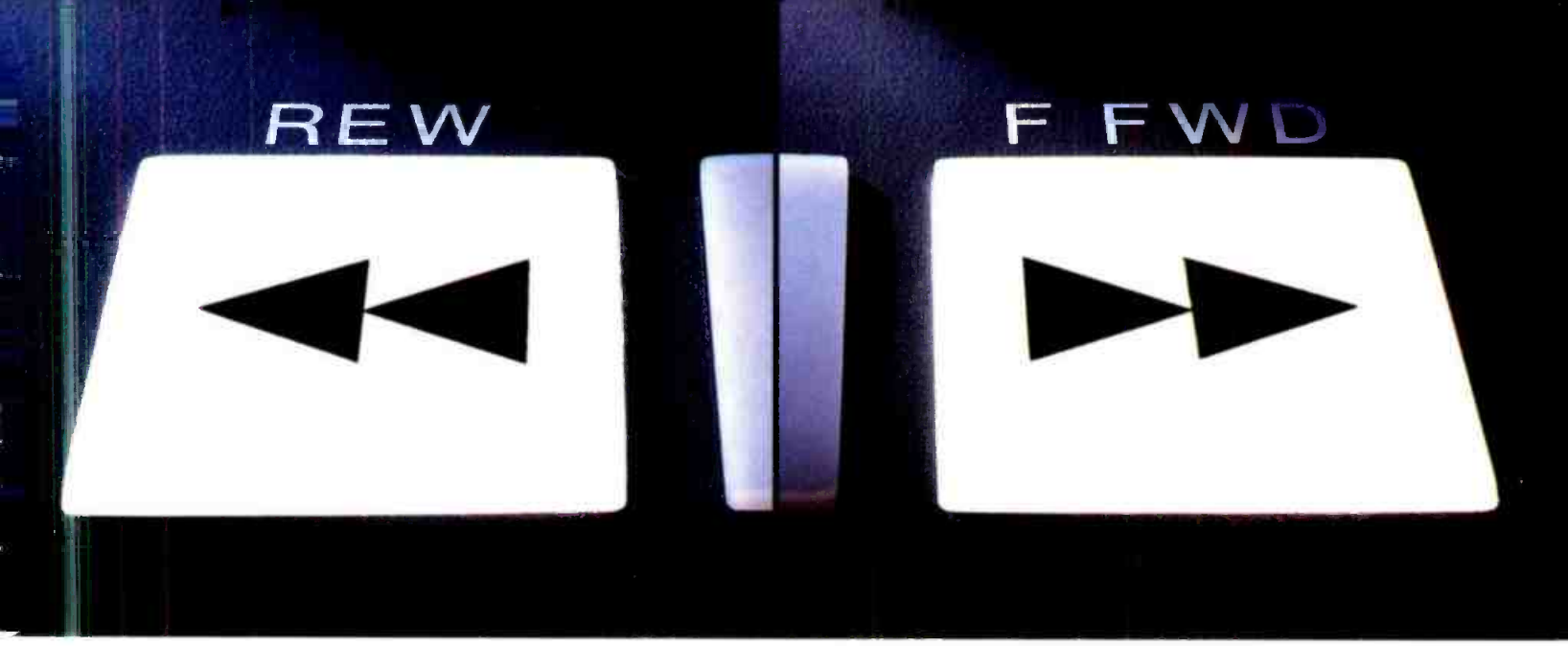
• *Tally and intercom.* Make sure there are enough outputs on the intercom system to serve twice as many users as you plan to have. Because the CCUs can be cross-patched into different switcher inputs, also make some provision for patching the tally outputs of the switcher to different CCUs. There can be some elaborate systems for this function, but a simple binding post (banana plug) patching arrangement will do nicely. Plan for a way to isolate the cameras from the production intercom system for occasional private conversations between camera operators and the video or maintenance engineers. Some cameras already have a built-in feature to accomplish this.

• *Audio.* Decide early on whether remotes are going to be done in stereo, because this will greatly influence audio console choice. In any case, it is imperative the mobile unit be wired with uniform polarity (high/hot, low/cold and ground/shield) throughout. As with video, every audio input source (both mic and line) should appear at the patchbay. This will increase system flexibility, save setup time and ease troubleshooting.

Audio control room of a mobile production unit. Window above console looks into production control room.

• *Videotape.* For sports work, tape has two functions: preproduced segment playback and slow-motion replay. For the latter, the operator has to see that the input selected is the proper camera for an isolated shot. The operator also has to see the output of the VTR when cuing or playing the replay. This requires a dedicated input and output monitor for each VTR, and at the least, an easily seen line output monitor nearby so that the operator can tell when the machine is on the air. For preproduced segment playback, you could probably get by with only an output monitor. However, the machine used for this often does double duty as a replay device, so the normal in/out/line monitor configuration still applies.

• *Graphics.* Graphics operators (such as still-store and character generator) need to see each output channel, an input for still-store and a preview channel (which



IT MAKES THESE TWO BUTTONS OBSOLETE.

How much time have you spent over the last few years waiting to get there?

The Pioneer VDR-V1000 Rewritable Videodisc Recorder just saved you that much time and more. It offers instant access (0.3 seconds average) and the fastest, most precise frame-by-frame editing in a recording device.

Gone are the typical problems associated with shuttling and jogging. The VDR-V1000's unique, dual-head configuration lets you search while play, record while play, or erase and record simultaneously. With 32 minutes recording time, and non-linear playback capability, you can assemble-preview your edits in realtime before recording. No pre-roll or post-roll is necessary.

THE PIONEER REWRITABLE VIDEODISC RECORDER WITH INSTANT ACCESS.

For a quick return on investment, the VDR-V1000 offers endless possibilities to these and other operations:

On-line Non-linear Editing
Commercial Insertion on the Fly
Flexible Time Delay
Efficient Still Store
Instant Replay
News Presentation
Animation
Satellite News Gathering

With so much going for it, the VDR-V1000 leaves only one question unanswered: What are you waiting for?

For more information, press the buttons on your phone, and contact your regional Pioneer representative: East - Tom Mykietyn at (201) 327-6400; Midwest - Chris Boldt (708) 285-4500; West - Craig Abrams (310) 522-8600.

PIONEER

Pioneer Communications of America, Inc.
600 East Crescent Avenue Upper Saddle River, NJ 07458

Pioneer VDR-V1000 Rewritable Videodisc Recorder is a registered trademark of Pioneer Electronic Corporation.

Circle (30) on Reply Card

may not always be aired.) Even if graphics are not done on-site, but instead are inserted back at the station, communication with these operators is crucial. This is difficult, but plan for a reliable method of allowing graphics operators to hear the director and producer, even if they are in the same room.

• *Transmission.* Just as there is a master control at your station, there must be an equivalent facility in the mobile unit. It should contain a good quality color monitor, waveform monitor and vectorscope. It should be located where all video levels and signal timings are set. The video DAs should be near this point so that they can all be easily adjusted. For audio monitoring, use an extended range VU meter, and as high quality a speaker system as the space will allow. (Note that these speakers are in addition to the speakers at the audio console. There will be times where the audio and transmission booths may each need to monitor simultaneously different signals.) The X–Y input of the video waveform monitor (or a dedicated X–Y scope) also can be a useful tool for monitoring stereo audio. Finally, have some emergency backup phone line on hand to get program audio back to the station, in case the primary transmission link goes down.

Communicating with your station is vital to a smooth telecast.

Announce booth for Monday Night Football, connected to mobile unit by multiple audio, video and intercom circuits. Booth coordinator is at left.

• *Communications.* Communicating with the station, control studio or other video and/or audio sources and destinations is vital to a smooth telecast. Examine carefully how you communicate with your ENG/SNV vans now. The mobile production unit should be able to interface with the station in the same manner, as well as satisfy the unique communications needs of an extended-length program. Two-way radios, radio frequency interruptible foldback (IFB), BTSC PRO-channel and telephone hybrids are all considerations. If you are going to broadcast from established locations (such as arenas, shopping malls, civic centers or curbside locations), given enough advance notice, standard POTS (plain old telephone service) may work best for communications. Plan for two production unit telephones — one for engineering use and one for production, with an A-B switch between the two, in case either goes down during the broadcast. Furthermore, consider a third executive line for any station management personnel on-site to take calls and answer their pagers. Ideally, these phones should be old-style instruments, not electronic phones that need AC power to operate.

Continued on page 71

Unforgettable.

More Memory Is Only One Reason Our 18-Input Switcher Is So Unforgettable.

With a 100-event memory — much more than any other switcher its size — our new PDG-418 has all the features of our popular Prodigy.™ Plus lots more that you told us you wanted. Like a downstream keyer that can either be linked to the multi-level effects transition system or operated separately. An optional border generator for the downstream keyer. A key loop that allows key bus cut and fill to be looped through an external effects processor. Even a clean feed/third program video output that bypasses the downstream keyer and blanking processor. All of which makes our PDG-418 the best value around in a compact, affordable switcher. Call us today to find out more about the new PDG-418. Another American-made innovation from Videotek.

VIDEOTEK™
First, we listen.

243 Shoemaker Road, Pottstown, PA 19464 1 (800) 800-5719 (215) 327-2292 Fax: (215) 327-9295

Prodigy is a trademark of Prodigy Services Company.

Diversity reception for wireless microphones

Wireless microphones are becoming more dependable and affordable.

By Charlie Conner

The Bottom Line

Reliable service from wireless microphones has always been elusive. Broadcasters in particular require dependability when using wireless systems in live broadcasts. Diversity reception can go a long way in providing trouble-free operation of wireless mics by counteracting their biggest nemesis: multipath. Diversity techniques have been around for a while, but some recent developments have lowered the cost and improved the performance of these systems. $

Conner is project engineer for Telex Communications, Minneapolis.

A basic problem with wireless microphone systems arises from their line-of-sight transmission nature. Regardless of the manufacturer, frequency of operation or any other factors, wireless microphone transmitters radiate a wave that travels to the receiving antenna essentially in a straight line.

If this was the only signal the receiver had to deal with, no problem would exist. But secondary signals travel indirectly to the receiver by reflecting off of nearby objects, such as wiring, structural metals and furnishings. This can cause a partial or even a complete cancellation of the desired signal, because the reflected signal is the same as the original signal except for its time of arrival — the familiar *multipath* problem. The time differential is caused by the longer overall path from source to receiver that the reflected signal travels. The resulting phase difference at the receive antenna between direct and reflected signals can cause addition, subtraction or cancellation of the original signal, depending upon the relative wave conditions at the moment of their mutual arrival.

This is a natural and unavoidable phenomenon affecting all wireless systems. Multipath cancellation can even occur over featureless ground with no nearby objects, because reflections will still be caused by the earth's surface. The audible results of this cancellation in wireless microphone applications are noise and dropouts in the mic's audio output.

Because multipath cancellations are caused by phase anomalies, it stands to reason that the signal can be restored (or at least improved) with *phase correction*. There are several ways to accomplish this. How well each of them works depends on some basic physics and the actual implementation of each method.

Diversity defined

The theory behind diversity reception states that the phase cancellations caused by multipath interference are *location-limited*. This means that a cancellation occurring in one spot will not necessarily occur somewhere else at the same time. Therefore, if multiple, spaced-apart receive antennas are used, the likelihood that a serious cancellation will occur at every antenna's location at the same time is rather small.

The actual minimum spacing to be used between antennas is determined by the wavelength of transmission. At the VHF and UHF frequencies employed by wireless microphones, these distances range from a few feet to a few inches, respectively. Therefore, it is reasonably simple and practical to accommodate diversity reception (using two receive antennas) in many broadcast production applications.

Because multipath cancellations are caused by phase anomalies, the signal can be restored with phase correction.

Simply summing multiple, spaced antennas into a standard receiver is not the end of the story, however. The receiving system must be specifically designed to incorporate diversity reception. This involves an appropriate process of selection and/or mixing of the antennas' signals by the diversity receiver. Without such selection, the multiple antennas can actually make the problem worse by providing what appears to the receiver as more

"GET ME A PAINTBOX® NOW!"

...it pays to be graphic.

When you need great television graphics and you need them now, you need to get a Paintbox®. In broadcast, in post, totally integrated with Picturebox® still stores or standing alone, Paintbox has all the creative power, flexibility and speed you need for cost effective, high quality television graphics. So, don't put up with second best - don't even think about it.
If your graphics need to be as good as the competition's... so does your equipment.

PAINTBOX®

EVERYTHING YOU NEED FOR TELEVISION GRAPHICS

QUANTEL

Circle (33) on Reply Card

QUANTEL INC. 85 OLD KINGS HIGHWAY NORTH, DARIEN, CT 06820. TEL: [203] 656 3100. FAX: [203] 656 3459

Paintbox and Picturebox are registered trademarks of Quantel

reflections of the original signal. Therefore, the chances for signal cancellation are increased. Diversity receiver design is critical to the solution of the multipath cancellation problem.

Variations on a theme

In general, diversity reception is simply a method of minimizing the effects of RF signal fading. It is achieved by selecting/combining two or more sources of received RF energy that each carry the same signal, but differ in strength or signal-to-noise ratio. Several forms of diversity reception have been developed.

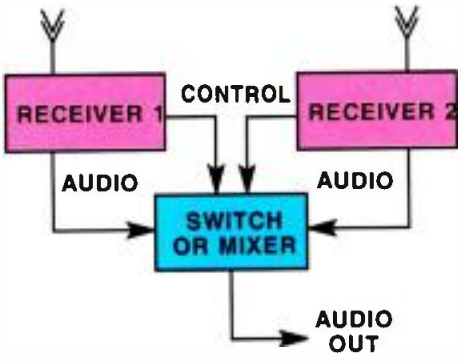


Figure 1. The original diversity receiver design, using two separate receivers with RF level sensing for external control.

The first diversity systems used two complete receivers, each with its own antenna. (See Figure 1.) The two systems' outputs were fed to a switch or mixer that was controlled by the strongest signal. This approach is not without its problems. First, simply building two receivers exactly alike in audio performance is not easy. Next, because two tuning systems are required, tracking between them is necessary, but difficult. Finally, the cost of two complete receivers and the system's associated complexity is considerable. Nevertheless, when these systems were introduced, the increase in performance was justifiable to those who could afford them and manage their complexity.

Subsequently, a simpler approach was developed, illustrated in Figure 2. It reduced system cost and improved reliability by placing two receivers (each with its own antenna) in the same chassis, along with internal switching and control. Many current systems use this methodology. This technique retains some of the previous generation's problems, however, primarily because two receivers are still required. In some cases, switching is performed in the RF (or IF) domain. In others, it occurs in the audio domain. The latter approach still requires two audio sections.

A third type of diversity receiver uses two antennas, but only one receiver. (See Figure 3.) The two antenna signals are combined ahead of the receiver, but a control loop in the RF path continually adjusts the relative phase of one of the antennas using delay, so that the two antenna's signals are always in-phase with each other. This method is called a *phase-diversity* system. Unlike many of the other two approaches' implementations, this method requires only one audio system and one

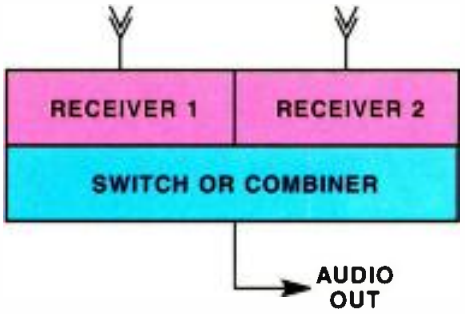


Figure 2. The most common diversity receiver design today, using two receiver front-ends in a single chassis with some shared electronics.

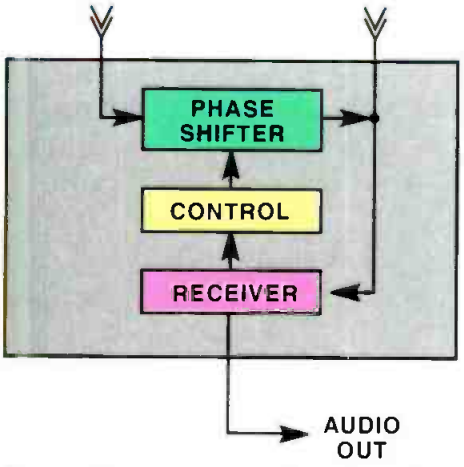


Figure 3. A diversity receiver design using only one receiver and RF phase correction.

control loop, which further reduces cost and improves reliability. Consistency also is improved over systems that use two separate receivers.

The control system in this last diversity approach uses logic circuits that monitor the combined signal strength delivered by both antennas. If the signal begins to drop or get noisy, the logic circuit reacts and adjusts the phase between the two antennas to restore the signal. Reaction time of the control system is set purposely slow, so that a transient anomaly does not cause the phase correction to react unnecessarily.

The delay applied by a phase-diversity system also affects the directionality of the receiver, much like the multiple antennas in a directional AM array are phased to obtain their pattern. In this case, however, the directional pattern of the receiver continually adjusts to the conditions at hand, optimizing the pattern to obtain the strongest signal.

Finally, phase-diversity systems keep both antennas active at all times, rather than switching from one to the other. This can provide an effective range increase of up to 25% over units employing 2-receiver diversity.

Until the laws of physics are repealed, the effects of multipath cancellation will always be with us. However, diversity reception for wireless microphone systems can help significantly reduce multipath's impact on broadcast production.

Diversity reception is simply a method of minimizing the effects of RF signal fading.

A wireless microphone receiver mounted directly on a camcorder streamlines the operation of a 1-person ENG crew.

➡ *For more information on wireless microphones, circle Reader Service Number 303.* ■

SONY'S NEW D-2 TAPE EXTENDS THE LIFE OF VIDEO HEADS AND HOT HEADS.

Thanks to our engineers, not only will Archie Bunker be around forever, but he'll actually cause less friction. Because we've developed a way to save broadcast history and your recording equipment with one remarkable tape.

Presenting an even better Sony D-2. Videotape designed to preserve the television classics that will become priceless pieces of America's history. Even after 22 years, you'll be happy to know that with Sony's help, the Bunkers, the Stivics and the whole *All In The Family* gang are doing just fine.

Determined to safeguard this celebrated series for future generations, Columbia Pictures decided to transfer *All in the Family* to the tender digital care of Sony D-2 videotape, where it will live on, unchanged by time. Over the years, countless television and film favorites have been relocated to Sony D-2 tape where they're continuing to entertain both new and old audiences alike.

The New D-2 Series Videotape

The safekeeping of these cultural treasures is not a trust Sony takes lightly. On the contrary, it's timeless pursuits like these that lead our own dedicated family of engineers to further discoveries in the world of digital tape.

Take our latest improvements to Sony D-2 Series videotape. Our Emmy Award-winning metal tape technology was only the beginning. We went on to perfect a unique lubricant process that significantly lowers tape friction. And, as a result, has dramatically improved video head life.

Which means Sony D-2 videotape not only lengthens the life of the programs you save, but equally important, prolongs the life of your video heads.

Still not content, we even gave the tape a stronger binder system for greater durability and a reduced error rate.

It's such endless advances that make Sony D-2 videotape a sought after media star among broadcasters, cable operators, duplicators and production houses. Advances that will keep other prominent stars shining brightly for a long, long time.

So good old Archie and Mike can stay just the way they are. Now that they're residing on Sony D-2 videotape, no one in that family will ever be stifled again.

SONY
SONY RECORDING MEDIA

Radio: An industry in transition

The first of a 12-part series on upgrading the radio station.

By Skip Pizzi, technical editor

The Bottom Line

Change for the sake of change does no one any good, but properly managed change can really make a difference. Today, options exist for improving the quality, productivity and profitability of the radio station. This new series will advise technology managers on how to proceed toward those ends. In this installment, the need for such changes and their consequences are considered, and the rest of the series is previewed.

This article begins a year-long investigation of the changing face of radio. Each month during 1993, this space will focus on a particular area of radio technology undergoing change. (See Table 1.) The underlying causes of these changes, and the benefits or pitfalls of conversion, will be considered to help radio broadcasters cope with the dizzying pace of progress in the industry.

In each area, industry experts will advise readers whether to make changes now or wait until later. These articles also will provide insightful filtering of the hype associated with many new products and trends. This will help you discern the straight facts, and find out if a particular replacement technology is right for you, right now.

Change seems to be engulfing the radio station on all fronts. Production systems, automation/origination systems, storage devices, signal processing, point-to-point transmission, broadcast delivery — these areas and others are all affected. It makes the technological landscape resemble a dense woodland as seen from the window of a speeding train. This series will approach the problem by reducing it into smaller parts and considering each area in detail.

Forest vs. trees

While exploring these individual tributaries, it's critical to stay focused on the big picture. This is easier said than done. As McLuhan put it, "I don't know who discovered water, but it was not a fish." The series will examine the whole of a station's operation and how each piece fits into the puzzle of incremental upgrading that most radio stations now face.

Taking things one step at a time is advisable, as long as you know where you want to end up. Each step should point in the same, positive direction. Although the journey's exact distance may be unknown, its general course should be understood. Our 12-step approach to this conversion process is clearly arbitrary. The upgrading process never truly ends, as shown in the familiar bridge-painting axiom: Start painting at one end, and work your way to the other; as soon as you finish, it's time to start painting at the first end again.

Change is engulfing radio stations on all fronts.

Timing is everything

The pace of this decision-making is crucial. Move too soon and you risk choosing the wrong format (or paying twice as much as you would next year). Move too late and you may find yourself playing an expensive game of catch up. Cicero advised, "More is lost from indecision than from bad decisions." He wasn't living on the cutting (or is it bleeding?) edge of broadcast technology, but he under-

Photo courtesy of WDNC-AM, WDCG-FM and Bartholomew Architects.

stood the inexorability of change and the need to respond to it.

A healthy dose of skepticism is still important, however. Run headlong into the future at great speed and you risk outpacing your headlights — by the time you see the brick wall, you may not be able to avoid crashing into it. This series will offer you some powerful high beams to stretch your range of vision — and some fog lamps to cut through the vaporware, as well.

Riding the storm out

Change will always occur, but its rate may vary. We are at a particularly steep part of the curve right now, as the conversion from analog to digital takes hold. Adapting to this sea of change may take us wide of our comfort zone. Most people don't like change, and the current experience seems more like a tidal wave.

FEBRUARY:	Digital Audio Storage Systems
MARCH:	Console and Switcher Technology
APRIL:	Digital Audio Production Systems
MAY:	Newsroom Production Systems
JUNE:	On-Air Audio Processing
JULY:	Program Automation Systems
AUGUST:	Remote-Control Systems
SEPTEMBER:	Point-to-Point Transmission (STL, RPU)
OCTOBER:	Remote Broadcast Production Systems
NOVEMBER:	New Profit Centers
DECEMBER:	Technology — Seizing the Opportunity

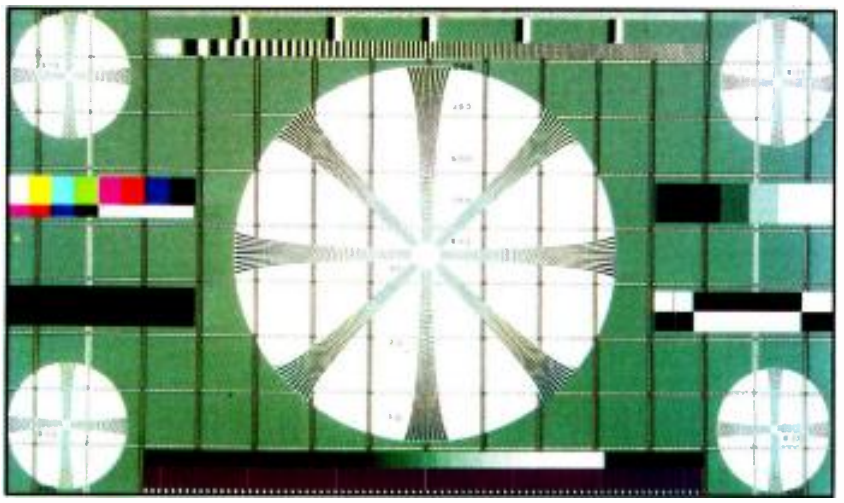
Table 1. A listing of the planned features for the "Radio in Transition" series during 1993.

Just as many of our ancestors learned the second language of an adopted land, we too must shed our decimal chauvinism and become fluent in the binary world. As a transitional generation, we'll probably always speak digital with an accent, but we must try our best to convert. Again, we are the generation that will be judged on the prudence of some formidable decisions. The wheels we set in motion will roll a long way. Will our legacy be grouped with Edison's or the Edsel?

Only time will tell. However, broadcasters should use that time wisely, and assure themselves that every decision is based upon the best available information. This series will try to provide just that.

Broadcast Engineering would like to hear from radio readers in 1993 with their reactions to these features. Let us know what you think about the topics and the coverage. If enough readers find these features helpful, we may continue the series beyond the end of the year. ■

We must shed our decimal chauvinism and become fluent in the binary world.



HDTV power devices: Considering the choices

It's important to know the strengths of the various HDTV power devices.

By Earl McCune

The Bottom Line

High-definition television offers new options to broadcasters, but at the same time, it brings many uncertainties. In some areas, even the questions are not completely formulated. Requirements for studios are more fully defined than those for the transmitter, yet planning for new transmission equipment is equally important. We can assume that most channel assignments will be UHF. Transmitter signal characteristics are crucial and so is the transmitter architecture, including the amplification devices. This article will discuss the applicability of various power devices for HDTV.

McCune is senior scientist for Varian Microwave Power Tube Products, Varian Associates Inc., Salt Lake City.

For broadcasters, the coming of HDTV has muddied the waters of transmitter amplifier selection. Once, broadcasters knew that standard klystrons were the only practical UHF choice. As more efficient devices were developed, the popularity of the standard klystron waned, but its performance was never questioned. With the advent of HDTV, the transmitter amplifier "map" is being redrawn.

The choices

The primary players are the Klystrode tube or the Inductive Output Tube (IOT), the standard klystron, the MSDC klystron and tetrodes. The Klystrode and IOT devices appear to be clear favorites and have received considerable attention for HDTV final amplifiers. The standard klystron will probably garner less serious consideration because of its dramatically reduced efficiency in HDTV operation. Tetrodes generally have better operating efficiencies than standard klystrons, but a 30kW peak-power capability could limit their use to lower power applications. That leaves the MSDC klystron. Is it simply a dressed-up klystron with the same inherent problems as the standard klystron, or is it a natural choice for HDTV operation?

Making comparisons

At first glance, it appears that klystron devices are not a good choice for HDTV. Nevertheless, many misconceptions about the compatibility of HDTV and klystrons exist. One common idea holds that the klystron bandwidth is insufficient for HDTV. However, Figure 1 illustrates a 1dB bandpass response for an MSDC-type klystron, proof of the inaccuracy of the idea. The achievable bandpass response, as shown, is a 7MHz bandwidth, as compared to the HDTV requirement of 6MHz.

Another common belief suggests that the amplitude linearity of a klystron is suspect for HDTV performance. Figure 2 illustrates the amplitude linearity of an MSDC klystron as similar to that of Klystrode tubes or IOT devices.

With the advent of HDTV, the transmitter amplifier "map" is being redrawn.

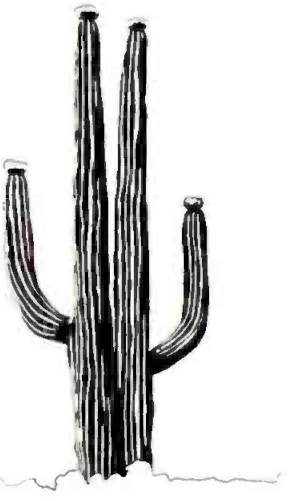
Two significant differences in linearity performance exist between the MSDC klystron and Klystrode or IOT device. First, the Klystrode and IOT devices show some non-linearities at low power levels. These are eliminated by biasing for Class AB op-

Come Face-To-Face With Your Future!

At NAB '93, the future will unfold for you as you explore the 500,000 square foot equipment exhibition, and as you take part in a convention of more than 250 seminars and technical workshops conducted by industry leaders.

NAB '93 is the only international convention and exhibition that offers you the full spectrum of new—and future—broadcasting, post-production, HDTV and multimedia technology and trends. From radio and television sales and marketing management to programming . . . from engineering to law and regulation . . . from multimedia to post-production.

Join more than 52,000 professionals from around the world at NAB '93—the world's largest marketplace of ideas . . . and come face-to-face with your future!



Fax-On-Demand!

Make sure you have up-to-the-minute convention details by using the new NAB '93 fax-on-demand service. Information on speakers, educational sessions, special events and activities is updated on a regular basis. Here's how it works... dial (301) 216-1847 from your touch-tone fax machine handset and follow the voice instructions. You pay only for the call.

NAB93

SUNDAY, APRIL 18–THURSDAY, APRIL 22, 1993
LAS VEGAS CONVENTION CENTER

Register Today!

Call (800) 342-2460 or (202) 775-4972.

To exhibit at NAB '93, call (202) 429-5336.

Circle (36) on Reply Card

eration. Second, the MSDC klystron displays some non-linearities at high power levels as a result of saturation. However, these fall outside the HDTV operating power range and have no impact on HDTV performance.

Efficiency factors

With respect to operating efficiency, MSDC klystron characteristics diverge from those of the standard klystron. The efficiency of an MSDC klystron is similar to the Klystrode tube or IOT device. Figure 3 compares the power conversion for the standard klystron, the MSDC klystron and the Klystrode tube or IOT, with points A (15%), B (35%) and C (39%) representing HDTV operating efficiency for the three devices, respectively. Figure 3 illustrates that as RF-output power requirements decrease, the DC-input power requirements for the MSDC-type device also decrease. Basically, this shows the same type of operation as Klystrode or IOT tubes.

BANDPASS RESPONSE FOR THE MSDC KLYSTRON

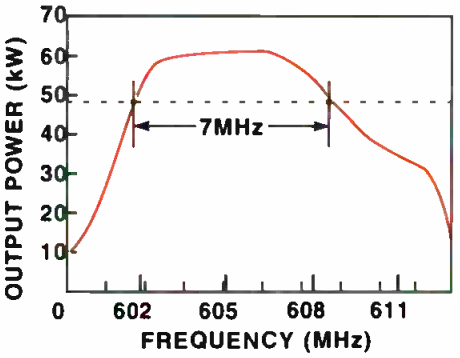


Figure 1. A 1dB bandpass response for a VKP-7990 MSDC klystron exists over a bandwidth of 7MHz.

Depending upon the peak-to-average power ratio selected for HDTV, the efficiency of the MSDC-type klystron ranges from 35% to 15% (for 5dB and 10dB down from the 1dB compression point or from peak power, respectively.) These levels are comparable to a Klystrode tube or IOT range from 40% to 22% efficiency for the same requirements.

The primary players are the Klystrode tube or the IOT, the standard klystron, the MSDC klystron and tetrodes.

AMPLITUDE LINEARITY: MSDC KLYSTRON AND KLYSTRODE TUBE/IOT

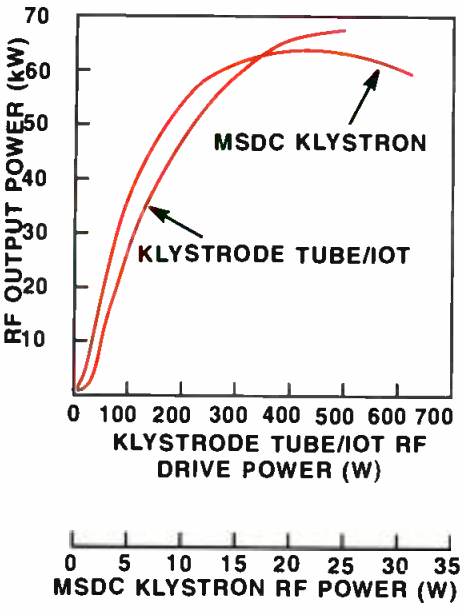


Figure 2. Good amplitude linearity for the Klystrode tube, IOT and MSDC klystron is shown. Peak power-handling capability of the Klystrode tube and IOT is also demonstrated.

The story does not end here. Operating efficiency figures presented for the MSDC klystrons assume optimization for current NTSC transmission. Optimization of the potentials of the collector segments effectively skews the efficiency curve for HDTV transmission. This produces somewhat higher efficiencies at the lower HDTV power levels. At a peak-to-average ratio of 10dB down from peak power, the efficiency of the MSDC klystron improves significantly to 18%.

POWER CONVERSION DIAGRAM FOR STANDARD KLYSTRONS, MSDC KLYSTRONS, AND KLYSTRODE TUBE/IOT

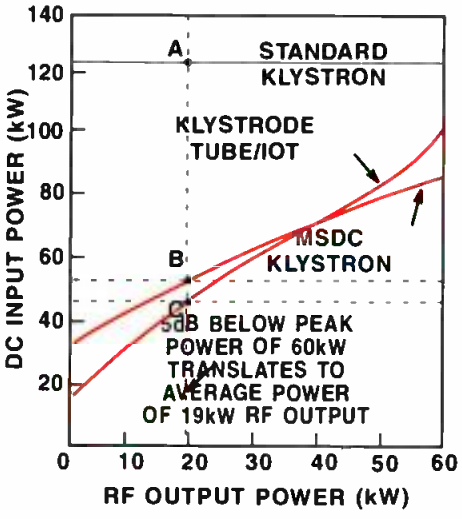


Figure 3. Points A, B and C represent HDTV efficiency for standard klystrons, MSDC klystrons and Klystrode or IOT tubes. HDTV operating efficiency is calculated as RF output power vs. DC input power. In terms of operating efficiency, Point A represents 15% for standard klystrons. For MSDC klystrons, Point B is 35%, while Point C represents the Klystrode tube or IOT at 39%.

Many misconceptions about the compatibility of HDTV and klystrons exist.

Reliability, performance

Another key feature of the MSDC klystron surrounds its demonstrated reliability and performance in the field. Because the MSDC device is an extension of klystron technology, the major components of the tube have evolved from decades of field operation. The cathode is the same as those used on standard klystrons and is expected to yield emission life of 60,000 hours or more. The collector, although more complex than a standard klystron, is projected to have a positive effect on expected life by recovering energy from the beam instead of allowing it to impact the collector at full power, therefore operating at reduced power density.

Although there is still a great deal of uncertainty regarding many areas of HDTV, the selection criteria for transmitter amplifiers is becoming clear. Based on the requirements presently predicted, both MSDC klystrons and Klystrode and IOT tubes appear well suited for highly efficient HDTV operation.

➡ *For more information on HDTV power devices, circle Reader Service Number 305.*

Editor's note: The Klystrode tube is a registered trademark of Varian Associates. The Inductive Output Tube (IOT) is a registered trademark of EEV. ■

More
than just another meter

✓ Meter ✓ Graphics ✓ Phase
✓ Sweeps ✓ Hardcopy
✓ PC-Link

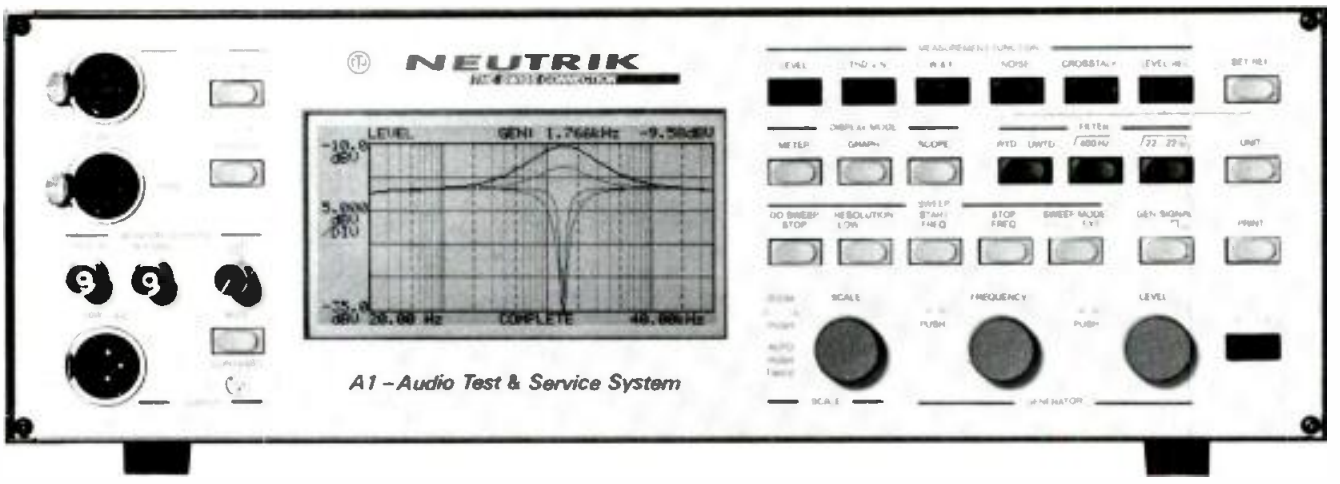
A1 PROFESSIONAL AUDIO & TEST SERVICE SYSTEM

It contains a sweepable (internally and externally controlled) generator, analyser and oscilloscope.

It measures level, noise, crosstalk (in absolute or relative terms), Frequency, THD, Wow & Flutter, drift and noise all with reliability and cost efficiency.

The large backlit LCD shows single measurements numerically along with a horizontal bargraph. Response curves are shown in a graphical form. The selectable cursor allows you to display an X-Y coordinate of a response curve for in-depth analysis from either the LCD or a standard matrix, ink jet, or laser printer.

Options available are; RS232 interface with an easy to use menu-based software package and our new phase function (model A1P). This thoroughly user-friendly instrument is auto-ranging, -tuning, -nulling, -scalling, calibrating and replaces up to eight conventional instruments.



A1 – Audio Test & Service System

Don't wait to try all Call today for a demonstration!

NEUTRIK
CONNECTING THE WORLD

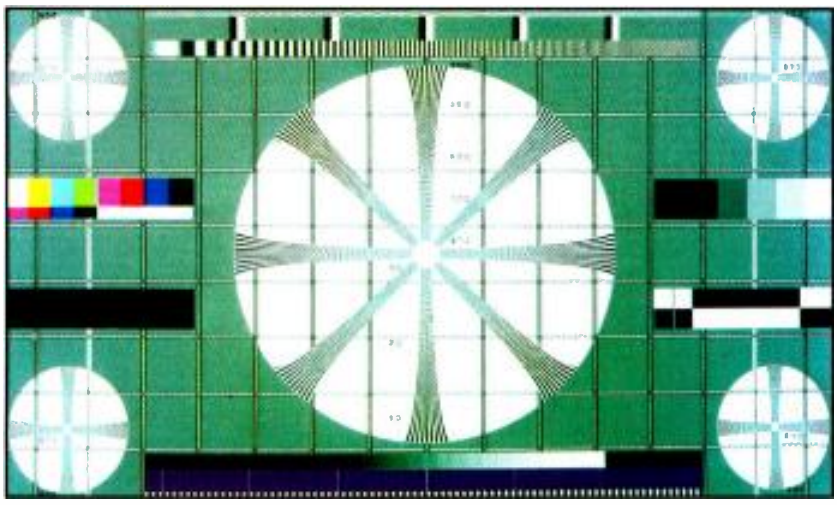
NEUTRIK AG
Liechtenstein
Tel 075/29666
Fax 075/25393

NEUTRIK USA INC.,
USA
Tel 908/901-9488
Fax 908/901-9608

NEUTRIK Marketing Ltd.
United Kingdom
Tel +44/71/792 8188
Fax +44/71/792 8187

NEUTRIK Zürich AG
Switzerland
Tel 01/7340400
Fax 01/7343891

Circle (56) on Reply Card



Digital modulation for HDTV/ATV

Gain insight into the HDTV transmission problem.

By Dr. Ron Totty, Bob Davis and Bob Weirather

The Bottom Line

Digital technology has made significant changes to the procedures used in signal processing. The same will be true for digital modulation of TV signals for HDTV. At stake is packaging the signal within the required bandwidth, and dealing with the data rates. One suggestion for HDTV modulation is the use of digital modems. This article will present some background for digital modulation.

Totty is vice president of engineering, Harris Corporation, Communications Sector; Davis is staff scientist, Harris Corporation, Electronic Systems Sector; Weirather is director of advanced development, Harris Allied Broadcast Division.

It is almost certain that the U.S. standard for high-definition television (HDTV) will involve some form of digitally compressed video with an output bit rate of approximately 20Mb/s. For over-the-air broadcast, HDTV will have to fit within the existing 6MHz TV channels.

The *compression* problem is to digitize the original HDTV signal and apply sophisticated compression algorithms, taking advantage of redundancy within pictures and between frames to produce a binary bitstream at a lower rate than required by the original digitized signal.

The *transmission* problem is to transmit the compressed digital signal over a 6MHz channel with minimum transmitter power and receiver complexity.

Separating compression and transmission

Handle compression and transmission problems separately. This separation provides a clean hardware interface as well as a clean division of responsibility for the overall performance of the HDTV system.

By making the digital modulator a part of the responsibility of the transmitter, the transmitter problem becomes a separate system. This allows the use of trade-offs between power, performance, spectral occupancy and the use of digital transmission techniques, which have no impact on the compression technique or on the receiver design. These techniques will allow optimization of the transmitter. A digital studio-transmitter link also can avoid the possible performance degradation in analog-to-digital conversions.

Bringing signals from the studio to the transmitter as a digital bitstream will require some changes in established operations. Conveying the compressed video bitstream from the transmitter to the home receiver presents a challenge. The bit rate of the compressed video is approximately 20Mb/s for all proposed digital HDTV schemes. One possible solution for the transmission is the proper choice of a good power and bandwidth-efficient digital modem technique to transmit and receive the compressed datastream. The following overview examines the fundamentals of this challenge. Important system questions, such as power ratings of UHF transmitters for equivalent coverage, ef-

It is almost certain that the U.S. standard for HDTV will involve some form of digitally compressed video.

Continued on page 64

YOU NO LONGER HAVE TO BE AFRAID OF THE DARK.

JVC PROFESSIONAL

Every once in while a new video camera comes along that will set the standards by which all other cameras of its type will be measured against.

JVC presents its low-light, 2/3" 3-CCD, high resolution KY-27 video camera.

The KY-27 features JVC's exclusive LoLux technology, which enables the camera to shoot in available light as low as 2 Lux. The latest in the long line of technological firsts from JVC, LoLux combines 24dB of electrical gain with an additional 6dB, which is produced by JVC's unique CCD pixel readout system, for a total of 30dB. All without the noise and picture degradation normally associated with this degree of gain.

In addition to 750 lines of horizontal resolution and 62dB signal to noise ratio, the KY-27 boasts a full range of automatic features, such as enhanced ALC, Full-Time Auto White and Full Auto Shooting. And the camera performs equally well when docked to your favorite VTR, or in stand-alone ENG and studio configurations.

Once you're armed with the KY-27 you'll never be afraid of shooting in low-light conditions ever again.

For additional information please visit your JVC dealer or call **1-800-JVC-5825.**

Circle (37) on Reply Card

RADIO'S TOP TEN! OTARI GIVES YOU BETTER CHOICES.

Otari's new audio recorders for radio give you features to fit any application or budget. This means you're not forced to make compromises when choosing a recorder, so your station sounds better to listeners, and is more efficient. And, of course, Otari's legendary reliability means less down-time.

On the forefront, there's a line of digital disk recorders including the new 2-track DDR-10, and the ProDisk 464 with up to 64 tracks for multitrack production.

Then, Otari's famous "workhorse" 5050 BII machine, the choice of radio professionals the world over, has become the BIII – just as tough, and twice as easy to use. And it has all the things you asked for, like a Q speaker, independent left/right reel size select, dynamic braking, and much more!

A new line of 2, 4 and 8-track machines, the 5050 MKIV Series, delivers state-of-the-art performance, plus features that will make your life easier, like a built-in autolocator with 3 one-touch, cue-point memories and return-to-zero.

Don't forget the MX-50II; a professional 2-track with a price that will astound you, and the MX-55 with all the features you'll ever need today, or tomorrow. (The "50II" and the "55" both offer a Voice Editing Module for normal pitch at twice play speed.)

Then there's our multi-tracks, from 32 tracks on down, at almost every price level – 8 machines, 12 different versions! And, of course, the CTM-10, a high performance cart machine we built for perfectionists, and an automated radio station reproducer.

Before you purchase *any* audio machine, look into Otari's line-up for the broadcaster. We think you'll find exactly what you need, at a price that fits your budget. Call Otari at (415) 341-5900 for more information.

OTARI

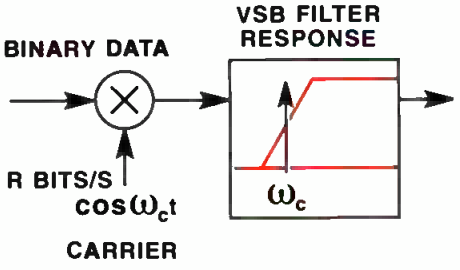
Circle (38) on Reply Card

Continued from page 60

fects of antenna patterns and mitigation of multipath propagation, fall outside of this discussion.

Basic digital modulator concepts

An early form of digital modulator for transmitting a serial binary datastream used phase shift keying (PSK). This means the phase of the carrier is either 0° or 180° for each transmitted bit. A more recent modulation scheme realizes that two PSK carriers could share the same frequency with the two carriers in quadrature (90° apart in phase). With quadrature carriers, no interference exists between the two bitstreams at the receiver baseband. This method, quadrature phase shift keying (QPSK), has the advantage of doubling the data rate in the same channel bandwidth. Figure 1 shows an alternate way to double the data rate over PSK. Here, a sideband filter simply slices off one sideband of the PSK signal. As shown, the sideband filter leaves a remnant or vestige of the removed sideband as vestigial sideband (VSB) signaling. With one PSK



VSB MODULATION

Figure 1. *A digital modulator scheme using PSK with VSB filtering.*

sideband removed, the data rate for VSB can be doubled for the same bandwidth as PSK, achieving the same throughput and bandwidth as QPSK.

Multi-amplitude modems

When the digital data rate is less than the channel bandwidth, schemes using binary 2-level pulses have been and will continue to be widely used. However, for the 20Mb/s rate of digital HDTV in a 6MHz channel, such simple schemes fall short of the mark.

To contain the HDTV signal within 6MHz requires a consideration of multi-amplitude extensions for the scheme in Figure 1. Rather than applying a 2-level binary signal, investigations have involved four or more levels. With 4-level inputs, each input voltage pulse carries two databits and the data rate can be doubled while keeping the symbol switching rate into the modulator, and the signal bandwidth, constant.

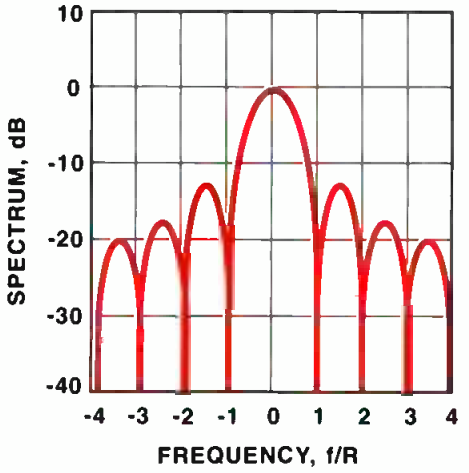


Figure 2. *Spectrum produced by square pulses.*

Such multi-amplitude schemes, in conjunction with carefully chosen spectral shaping filters, permit the transmission of a 20Mb/s datastream over a 6MHz channel.

Spectral shaping filters

Simple square wave voltage levels result in poor spectral sidelobes. Furthermore, they perform poorly if fed into the baseband ports of the mixers in Figure 1 to modulate IF carrier signals for HDTV. The baseband spectrum produced by random multilevel square wave pulses arriving at rate R can be defined by:

$$S(f) = \sin(\pi \cdot f/R)/(\pi \cdot f/R)$$

The spectrum is plotted in Figure 2. As shown, the bandwidth between the first nulls of the spectrum is 2•R, with the first sidelobes only 13dB down relative to the main lobe.

The addition of filtering to the baseband digital bitstream, as shown in Figure 3(a) and Figure 3(b), prevents interference with adjacent TV channels. But this must be done in a special way.

Filtering the baseband pulses rounds their edges, reduces the bandwidth of the radiated spectrum and causes the resulting pulse to spill into adjacent pulses. If the filtering is not properly performed, interference between symbol pulses (called intersymbol interference, or ISI) begins as the filter bandwidth is narrowed.

The filters required to prevent sequentially transmitted pulses from interfering with one another while narrowing the bandwidth as much as possible were discovered by Nyquist in 1928.

Nyquist filters

Nyquist proposed an overall filtering of baseband pulses, from the transmitter baseband input to the receiver baseband sampling point, to have a flat frequency response over the passband and a response rolloff that is symmetrical at approximately the frequency equal to half the pulse rate. Under those conditions, no interference between pulse samples occurs at the receiver in the sense that if a given symbol is sampled at its peak, the adjacent pulses are passing through zero at that time.

Many digital modems include Nyquist filters, and all the digital HDTV proponents use them in their over-the-air tests.

Eye patterns

Referring to Figure 3, a received baseband signal at point (1) drives an oscilloscope vertical deflection input while the horizontal sweep rate is locked to the symbol rate clock. The scope displays a picture, as illustrated in Figure 4.

Each beam traverse across the screen traces yet another symbol length segment of the received baseband waveform. Because of phosphor persistence of the oscilloscope screen, each trace remains visible for many symbol times. Thus, the scope display represents a superposition of many one-symbol length waveform time segments. The oscilloscope image is called an *eye pattern* or an eye diagram because it resembles several open eyes.

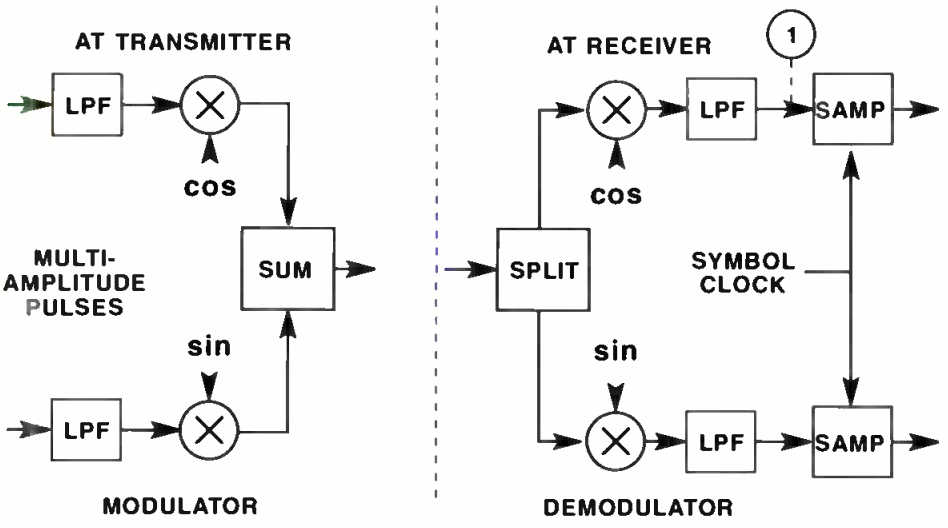
In Figure 4, 4-level amplitude pulses are used on the monitored modem. The point in the center of the eye pattern where the four levels become sharply defined represents the periodically recurring symbol time at which the baseband signal should be sampled and decisions made on which of the four amplitude levels was transmitted. The sharp definition of the levels results from the absence of any intersymbol interference at this ideal sampling time with Nyquist filters.

Transmission channel distortions, such as amplifier non-linearity and propagation multipathing, blur the sharpness of the eyes and produce performance degradation. You can quickly assess the quality of the link by examining the received eye pattern. If the center levels are sharply defined, little degradation in performance will occur. If the eyes show significant closure, severe degradation in the presence of channel noise can be expected.

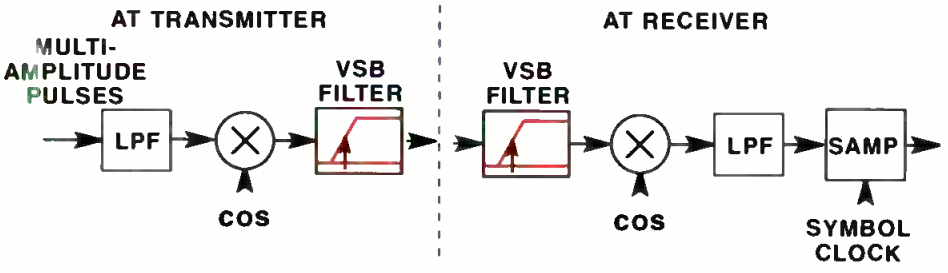
Signal constellations

For a QAM modem, if you plot all possible pairs of in-phase and quadrature channel pulse samples at the receiver (normalized to values of ±1, ±3, etc.), a set of points as shown in Figure 5 results. A fancied resemblance to an array of stars in the sky named this set of points the signal "constellation" for a digital modem. The constellation shown is that for 16-QAM, one of several schemes proposed for HDTV. Other schemes use 32-QAM and 4-VSB.

Think of the receiver demodulation task as the mapping of any noisy received (I,Q) pair of sample voltages into the closest of



A) MQAM MODULATOR/DEMODULATOR (MODEM)



B) VSB MODULATOR/DEMODULATOR (MODEM)

Figure 3. MQAM and VSB modems with spectral shaping low-pass filters.

the possible noiseless points in the signal constellation. Mark off the regions that are mapped by the receiver onto each of the points, as illustrated by the grid lines in Figure 5. When a received pair of quadrature channel samples falls anywhere in the region (a "decision region") containing a constellation point, the digital receiver produces the binary bits associated with the contained point.

Bit-error rate

Some fraction of transmitted bits will be received in error because of noise and other channel impairments. *Bit-error rate* (BER) is the ratio of the number of bits received in error to the total number of bits transmitted. An equivalent term is *probability of error*. How well a digital communications system works is almost entirely characterized by its BER and the signal-to-noise ratio required to produce that BER.

Peak/average energy

For NTSC, it is common to use a peak signal power-to-noise ratio where peak means peak-of-sync, and the bandwidth in which noise is measured is 6MHz. The peak power for a QAM system occurs when the maximum amplitude occurs at the same time on the sine and cosine (quadrature) carriers. In terms of the signal constellation, think of the transmitted energy in each of the digital modem transmit symbols as proportional to the squared length of the vector from the origin to each individual symbol's constellation point. The average energy per symbol is proportional to the average of the squared lengths to all the signal constellation points. Over a variety of picture content, it is reasonable to assume that the symbols occur with approximately the same probability.

For pulses lasting longer than a symbol time, such as those for the raised cosine filters, the peak transmit signal rises momentarily higher than the length of the longest constellation vector by a peaking factor determined by the rolloff of the filter. This causes the peak-to-average power ratio to be greater than the simple calculation of peak-to-average squared lengths to constellation points.

The peak/average power ratio for a digital transmitter relates to sizing the transmitter power amplifier. A certain average output power level, which depends on the chosen signal constellation, must be transmitted to achieve a desired level of received signal quality. However, the amplifier must have the capability of handling power levels higher than average, or the peaks will be distorted by amplifier saturation. Too much distortion degrades performance and causes the transmit spectrum to splatter into adjacent channels.

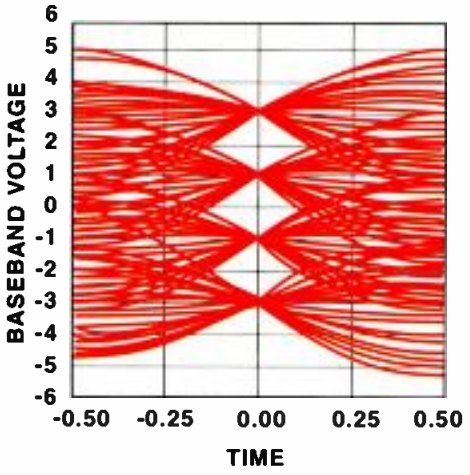


Figure 4. A 4-level eye pattern.

The distortion on signal peaks does not necessarily have to be zero. Rather, the performance loss and spectral splatter simply must be held to acceptable levels. Amplifier distortion should be modeled, and performance and spectral characteristics examined through computer simulations (or through measurements), before drawing conclusions about the peak power capability needed in power amplifiers for HDTV transmissions.

Signal-to-noise ratios

Confusion about signal-to-noise ratios (SNR) often arises because assumptions of the signal power and noise power in plotting a BER vs. SNR curve are not clearly stated. For example, is the signal average or peak power assumed? Also, what receiver bandwidth is represented? For NTSC, peak signal power-to-noise power in a 6MHz bandwidth is normal. In digital systems, it is common to use average signal power-to-noise power in a bandwidth equal to the bit rate (usually denoted by Eb/N0). Another frequently used SNR relates the average signal power to the average noise power measured in the receiver's IF bandwidth.

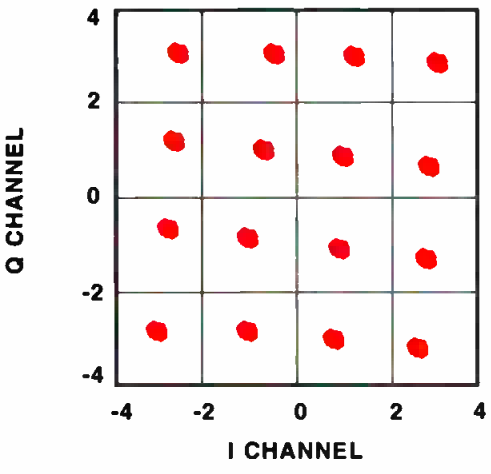


Figure 5. Signal constellation pattern for non-linear PA distortion on 16-QAM modulation.

When considering the performance of a digital system modem with a given BER at a specified SNR, determine what definitions of signal and noise power are assumed and in what bandwidth the noise was measured. Curves of BER vs. SNR prove little without such information.

Power amplifier non-linearity

Distortions from power amplifier non-linearities on an analog NTSC signal cause the received video waveform to differ from that transmitted, even under high SNR conditions. Such distortions can cause visible effects at the receiver.

Unlike NTSC, HDTV typically shows no visible effects for small distortions when operating under high SNR conditions.

Handle compression and transmission problems separately.

Small, fixed distortions caused by power amplifiers and filters do not move received constellation points outside their respective decision regions with any appreciable frequency. If they did, there would be a fairly high, unacceptable error rate floor, no matter how high the SNR. A properly designed HDTV scheme will control amplifier distortions to keep all constellation points within the decision regions so that no errors occur at high SNR.

Bringing signals from the studio to the transmitter as a digital bitstream will require some changes in established operations.

On the other hand, distortion does render an HDTV signal more vulnerable to errors caused by random noise in the transmission channel. Effectively, the constellation points are moved to locations nearer a decision region boundary where smaller random-noise excursions can cause errors.

Adaptive predistortion and PA non-linearity

Figure 5 shows typical distortion of digital signal constellation points by non-linear power amplifiers. Note how larger amplitude points move father away from ideal positions than those of low amplitude. This results from increased saturation distortion of the power amplifier as the input drive level increases. To control the distortion, predistortion can be applied, which causes the points (when distorted) to move back to their proper ideal constellation locations. Such a predistortion technique can automatically adapt to and track time variations in non-linear power amplifier distortion. This adaptive predistortion holds the transmit signal constellation points precisely at the ideal locations, even when characteristics of the power amplifier slowly change. This leads to an extremely robust HDTV transmitter.

The cliff-effect

When examining the constellation and associated decision regions shown in Figure 5, note that no errors will be made in receiving the data as long as the equipment distortions and noise do not push a point outside its decision region. This fact accounts for a digital modem ability to display essentially no degradation in performance until a critical low S/N ratio is reached. At that point, the noise causes frequent excursions of the received constellation points outside their respective decision regions. This causes the rapid performance degradation known as the cliff effect.

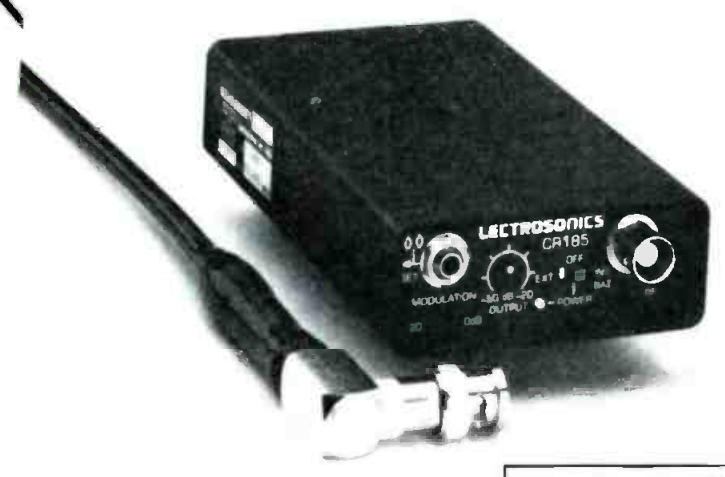
Summary

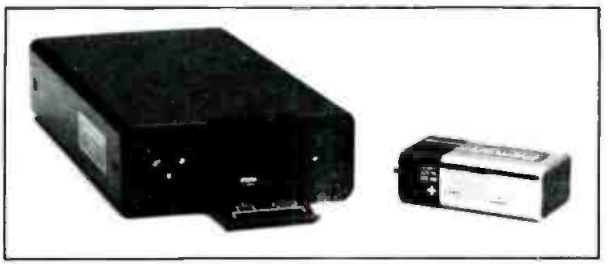
This overview of digital modulation/demodulation basics should provide insight into the HDTV transmission problem. In addition, it serves as a background for understanding other HDTV topics involving broader system issues, such as comparisons of HDTV and NTSC transmitter sizes for equivalent coverage, the effect of power amplifiers on performance and spectra of HDTV signals.

➡ *For more information on digital modulation, circle Reader Service Number 306.*

■

W makes the best ENG wireless ophone system?



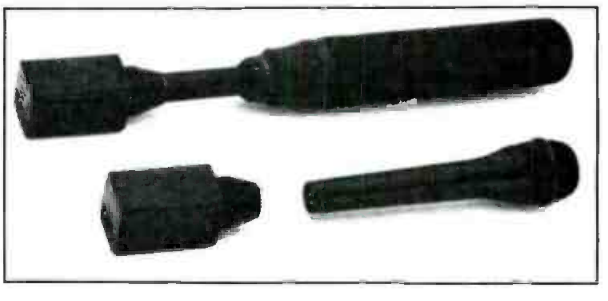


The best mini-receiver . . .

The CR185 offers a six-pole helical resonator front-end, followed by narrow-band crystal IF filtering at 21.4 MHz. This provides unmatched selectivity and sensitivity, and minimizes drop-outs and interference. A balanced, XLR output interfaces with any professional camcorder.

The best belt-pack transmitter . . .

The M185 is a highly refined belt-pack transmitter. It matches any input requirement and provides "phantom power" for almost any lavalier microphone via a standard 5 pin jack. The belt-clip is constructed of machined aluminum and steel parts, spring-tensioned for a secure fit on any belt or fabric. Audio level LEDs are provided on the control panel for accurate level adjustment.



The best "plug-on" transmitter . . .

The H185 introduces new flexibility to your ENG operations. It makes any hand-held or shotgun mic with an XLR connector wireless. The microphone body becomes part of the antenna circuit, forming a very efficient RF radiator. The audio input level is indicated by two LEDs next to the microphone coupler. These LEDs are clearly visible with the microphone attached for accurate level adjustment.

The best construction . . .

All external parts are constructed of machined aluminum for ruggedness and durability. Shock-mounted crystals are used in the IF filtering and oscillators for reliable operation. The transmitters and receiver are built for the real world of hard knocks.

The best factory support . . .

Whether it's frequency coordination or follow-up service, Lectrosonics will come through. Our commitment to the needs of broadcasters is second to none. Call us with questions, and you will get answers that make sense.

Call us toll-free to locate your nearest dealer:

1-800-821-1121

LECTROSONICS, INC.

P.O. Box 15900 • Rio Rancho, NM • 87174
581 Laser Rd. NE • Rio Rancho, NM • 87124
(505)892-4501 • (800)821-1121

Circle (40) on Reply Card

1993 industry forecas

Part 2 of our 1993 forecast examines the types of equipment that stations are planning to buy.

By Brad Dick, editor

In our December issue, the article, "Perspective: An Industry in Transition," provided a glimpse of what stations are planning for 1993. The information was based on the state-of-the-industry survey performed by the Intertec marketing research department. For more information on how the survey was conducted, see page 26 of the December issue of *BE*. This month's article completes our look at how our readers view the next 12 months. In a nutshell, things look promising.

To make the information as useful as possible, this year's survey asked questions about the specific types of equipment that stations planned to purchase. In previous years, we asked what areas of the station would be upgraded. The data in this report is more specific and should be more helpful in developing a picture of station plans for 1993. See Table 1 for a summary of the data concerning equipment purchases.

The issue for readers isn't whether they will be purchasing equipment, but what equipment will be bought.

It's where to spend, not whether to spend

The issue for readers isn't whether they will be purchasing equipment, but what equipment will be bought. Our research shows that stations have moved from a holding pattern into a buying mode. Let's examine what equipment TV stations are planning to purchase.

Monitors and videotape recorders (VTRs) are the most-sought-after types of equipment. Almost 54% of the TV stations surveyed said they plan to purchase monitors. Following a close second were video recorders. Approximately 52% of the stations indicated that they included new VTRs in their purchasing plans. These two categories represent the most-popular types of equipment in the survey.

Cameras were the third-most-desired equipment for TV stations. Approximately 42% of the respondents noted that new cameras were included in their budget, which is good news for camera manufacturers and production staffs. In addition, the research indicated that acquisition, storage and monitoring equipment was high on the list of what stations want.

Fourth on the list of most-commonly planned purchases for TV stations was test equipment. With a 40% response rate, it appears that stations are finally replacing old waveform monitors, vectorscopes and maintenance test equipment. There also appears to be a renewed interest in automated test equipment, as indicated by some of the verbal responses.

Other popular planned purchases included microphones (36%) and editing equipment (33%). Signal-processing and routing/distribution equipment were almost equally popular at 27% and 26%, respectively.

Our research shows that stations have moved from a holding pattern into a buying mode.

Radio plans

Almost 47% of the radio respondents said their stations were planning to buy audio recorders and players. The second preferred type of equipment for radio stations was test equipment. Although this trend parallels the purchasing plans of TV stations, fewer radio stations plan to buy new test equipment than TV stations.

Audio consoles were the third-most-desired type of equipment. Slightly more

Base = all respondents; multiple answers	Weighted Grand Total by Market Rank	Weighted TV Subtotal by Market Rank	TV Top 50	TV Top 51 to 100	TV Below Top 100	Weighted Radio Subtotal by Market Rank	Radio Top 50	Radio Top 51 to 100	Radio Below Top 100
Audio recorders/players	44.6%	16.6%	23.4%	15.3%	10.1%	46.6%	60.4%	49.2%	43.2%
Test equipment	27%	40.3%	43.8%	39.6%	37.2%	26%	29.7%	23.1%	25.3%
Microphones	23.7%	35.6%	39.4%	33.3%	33.1%	22.9%	43.2%	26.2%	17.8%
Audio consoles	23.6%	17.1%	21.2%	16%	13.5%	24.1%	31.5%	29.2%	21.9%
Signal processing	20.3%	27.2%	32.8%	26.4%	21.6%	19.8%	34.2%	18.5%	16.4%
Monitors (audio & video)	18%	53.5%	59.1%	52.8%	48%	15.4%	22.5%	24.6%	13%
Automation equipment	15.7%	21.3%	31.4%	15.3%	14.9%	15.3%	11.7%	12.3%	16.4%
Transmitters	13.8%	11.2%	13.9%	13.9%	6.1%	14%	15.3%	13.8%	13.7%
Antenna systems	13.6%	10.5%	14.6%	11.1%	5.4%	13.8%	20.7%	12.3%	12.3%
Signal routing/ distribution	13.4%	26.3%	30.7%	24.3%	23%	12.5%	14.4%	16.9%	11.6%
Editing, including desktop systems	7%	33%	36.5%	30.6%	31.1%	5.2%	12.6%	4.6%	3.4%
Video recorders	5.6%	51.5%	58.4%	47.9%	46.6%	2.3%	0.9%	1.5%	2.7%
Remote production vehicles/pgm relay	5.2%	9.2%	13.1%	7.6%	6.1%	4.9%	15.3%	1.5%	2.7%
Cameras	4%	41.9%	46%	35.4%	42.6%	1.3%	0.9%	1.5%	1.4%
Graphics/effects/titlers	2.5%	28.3%	33.6%	28.5%	22.3%	0.7%	0.9%	0%	0.7%
Video switchers	1.5%	18.9%	23.4%	18.8%	14.2%	0.3%	0.9%	1.5%	0%
Other	8.8%	9.6%	6.6%	9%	13.5%	8.7%	7.2%	10.8%	8.9%
No purchases planned in 1993	20.3%	6.5%	2.2%	6.9%	10.8%	21.3%	10.8%	18.5%	24%
No answer	1.1%	2.8%	3.6%	3.5%	1.4%	0.9%	1.8%	1.5%	0.7%

Table 1. The chart shows, by percentage, the number of survey respondents planning to purchase each category of equipment. The totals add to more than 100% because multiple answers were required.

than 24% of the respondents said they plan to purchase at least one. Microphones were the fourth-most-desired equipment purchase. Approximately 23% of the radio stations said they planned to buy new microphones in 1993.

The percentage of stations wanting the next six types of equipment remained relatively constant, from 13% to 20%. (See Table 1.) The numbers dropped off rapidly from this point. For example, only 5% of the radio stations surveyed saw the need for new remote production vehicles and program relay equipment.

Approximately 52% of the (TV) stations indicated that new VTRs were included in their purchasing plans.

Overall needs

Considering the total equipment marketplace, more stations plan to purchase audio recorders and players than any other equipment. Test equipment is the next most-popular category. Microphones, consoles, signal processing and monitors round out the top six types of most-desired equipment. Automation equipment was preferred by 21% of the TV stations but only 15% of the radio stations.

Better times are at hand.

Responses to the statement, "No purchases planned in 1993," showed divergent plans between radio and TV stations.

Only 7% of the TV stations responded that they had no equipment purchase plans for this year. However, three times as many radio stations (21%) said they would not buy any equipment in 1993. A look at this issue shows that for television and radio, the decision is primarily market-size-dependent. For example, 24% of the radio stations in the below top 100 markets said they would not buy equipment this year. However, only 11% in the top 50 markets gave the same response. For television, the numbers are lower. Only 11% of the TV stations in the below top 100 markets said they would not purchase equipment in 1993. Not surprising, that figure dropped to 2% in the top 50 markets.

What does this mean for the technical staffs at radio and TV stations? It means that better times are at hand. New equipment may be only months away, and with that comes higher quality and more reliable service for our audiences.

Broadcasters have consistently met the challenge of providing high-quality service to their audiences. It's refreshing and heartening to see these facilities again investing in their own future. Almost everyone should benefit from that effort.

New equipment may be only months away, and with that comes higher quality and more reliable service for our audiences.

Survey results available: The complete survey is available for only $245. This bound edition, filled with tables and data, provides detailed information on industry demographics, station use of engineering services, planned purchases by equipment category and convention/trade show attendance. Contact Diane Mason at 913-967-1735 for more information. ■

Continued from page 46

You must be able to communicate even if a loss of power occurs.

Interior design

Laying out a mobile unit is an art form in itself. The quickest way to get an appreciation for the skills involved is to look at numerous other trucks. Rely on the expertise of a systems vendor or a consultant with experience in designing mobile unit interiors.

Everything moves in a mobile unit, and is subject to stresses it would not encounter sitting in the studio. Every rack-mounted piece of equipment in the mobile unit must be supported from the rear, in addition to using all of the screws on the front. The rack ears will not support the entire weight of the unit when it is rolling down the road. Don't rely on gravity to hold anything in place. If you want something to stay where you left it, screw it down or secure it with some other positive means.

Documentation and spare parts

Just as you did for your studio installation, plan for maintenance and repair. Remember, no matter how new or how good the equipment is, it will break. Someone will have to fix it, and it may not always be you. Therefore, document everything clearly. Every wire (video, audio, control, intercom, telephone) must have a wire number and a legend of what equipment it connects to, if possible. The time spent creating video, audio, power and control functional diagrams is not a luxury or just doing a neat job. It is a necessity.

The manufacturer's recommended list of spare parts and a copy of the service manual for all equipment on board should be carried on the truck at all times.

Consider purchasing complete units as spares for all critical items (monitors, DAs, headsets, and maybe even a camera if you use the same model at the station).

Courtesy of Advent

A mid-size mobile unit with separate compartments for transmission (at left door) and production.

Conclusion

The station's size, budget and intended market will each play a major role in deciding what type, brand and quantity of equipment to install in the mobile unit. Only you can make those hard decisions. No matter what equipment is chosen, the truck's overall design and the equipment's installation will make the difference in how well it functions.

➡ *For more information on remote vehicles, circle Reader Service Number 300.* ■

1992 Article Index

HDTV

MANAGEMENT

RADIO

REMOTE

RF/TV

TRANSMISSION SYSTEMS

VIDEO

■

Field Report

Nady 750 VHF wireless system

By Lloyd Collins

The wireless microphone has become a regular item in the remote kit of most radio and nearly all TV stations. The use of wireless microphone systems on the theatrical stage and in concert has also become standard practice. As the demand for these systems has increased, many new systems have arrived on the market. Today's broadcast engineer can choose from a wide variety of wireless microphone systems. They range from basic and inexpensive to sophisticated and costly.

The Nady 750 wireless system falls in the middle of this range. It is typical of mid-line offerings in many respects, but provides a few new attractions. The unit's most notable difference from other systems is its 2-channel nature. The receiver contains two separate systems (each operating with diversity front-ends) with completely independent controls, indicators and outputs in a 1-rack-space chassis. The only items shared by the two channels are the power supply, the antennas and the enclosure. I have always carried two wireless receivers on remote broadcasts, and have found the 2-channel receiver to be more convenient than multiple single-channel receivers.

The system consists of the receiver and your choice of hand-held microphone, body-pack transmitter with a mini-XLR input connector, body-pack transmitter with hard-wired lavalier mic, and/or an instrument system transmitter with an input ready to connect to any musical instrument's high-impedance pickup. The test model came with a hand-held microphone and a body-pack transmitter with a mini-XLR. The mating mini-XLR male connector was included, along with telescoping rod-type antennas, power cord and rack-mount adapters for the receiver. For the hand-held microphone, this evaluation system substituted the Nady HT-40, which is a component of the manufacturer's more expensive (but compatible) wireless system 1200. It can be ordered for the 750 system as an optional upgrade.

Collins is cheif engineer for KCMO-AM/FM, Kansas City, Mo.

Performance at a glance:

- *Two microphone channels in one box save space, setup time and expense*
- *True diversity receiver mitigates multipath problems*
- *Offers multiple microphone options*
- *Receiver can be battery powered (externally)*
- *Wide dynamic range and comprehensive metering*
- *Adjustable squelch and audio output controls*

When two microphones are supplied, they are set to different frequencies so they can be used simultaneously with the 2-channel receiver.

Layout and operation

The receiver for the system is uncomplicated. The front panel has a power switch, level controls for the audio output of each channel, a pair of 2-color, 5-segment LED bars indicating signal strength for each channel, and another pair of similar LED meters for each channel's audio level. Also, each channel has "A" and "B" indicators showing which receiver in the diversity system is currently active for that channel. The rear panel has connectors for the two antennas, balanced (XLR) and unbalanced (1/4-inch T-S) audio outputs for each channel, recessed squelch controls for each channel, and the fuse and power connections. The receiver is housed in a metal enclosure equipped for either rack-mount or table-top use.

The power cord is a standard 3-pin IEC type, and because the power supply is inboard, there is no "wall-wart" outboard supply to take up two (if not three) outlet spaces on the power strip. The receiver can also be powered by an external 12VDC-18VDC source. The telescoping rod antennas provided are well made and should stand up to moderate abuse. The rack-mounting ears are made from some type of plastic, however. They seem thick enough, but severe mechanical stress might cause some problems.

The RF section operates with true diversity, using two separate receiver front-ends for each of the two channels in the receiver. The system will automatically pick the front-end getting the better signal for use by the rest of the receiver. This method of reception is highly recommended for wireless microphone systems. It eliminates nearly all momentary audio dropouts caused by multipath problems. (See "Diversity Reception for Wireless Microphones," on page 48.) These become especially severe when the area you are trying to work in is structurally complex, such as a stage with lots of equipment and construction or a restaurant with many tables, columns and alcoves.

The hand-held microphone (HT-40) is well-balanced and comfortable to hold. Its case is made of metal tubing. The battery (standard 9V) is accessed by unscrewing the lower part of the tube casing. The manufacturer claims that the dynamic transducer element on this microphone is performance-equivalent to the Shure SM-58. Although this evaluation did not include tests necessary to confirm that claim, the microphone sounds good.

If you consider purchasing a Nady 750 system, you might want to step up to the HT-40 hand-held mic. It could be a worthwhile investment. Range of operation for the hand-held microphone was acceptable, extending beyond 500 feet in typical remote situations.

The body-pack transmitter also worked well. The test version used an 11-inch wire for its antenna. It was usable over a slightly greater range than the hand-held microphone under similar conditions. (The hand-held version uses a portion of its outer case as its antenna.) The input connector is a 3-pin Switchcraft TA3 type with ground, bias voltage and audio input available. The instruction sheets list connections for most popular lavalier microphones. The body-pack transmitter is useful for many odd jobs on a remote. For example, at one remote, the picture at a baseball game was fitted with it. For normal talent use at a radio remote, the hand-held microphone will typically be used.

Both transmitters performed well in objective tests. A spectral analyzer failed to pick up any signs of RF spurs or other problems. The body-pack transmitter exhibited a bit higher output when tested on the spectrum analyzer, confirming the impressions noted previously regarding its wider range. (For these tests, one of the rod antennas provided with the wireless system was used on the input to the spectrum analyzer.)

The audio performance of the system was judged by several programming and technical people to be extremely good. The system uses a companding scheme that nets a claimed 120dB of dynamic range. Objective tests did not specifically examine dynamic range, but did verify that the system can perform over a wide range with no objectionable distortion. This is one of the better-sounding wireless microphone systems in its price range, and seems to outperform some that cost significantly more.

In KCMO's tests, the system was used in a wide variety of remote broadcasts over a 3-month period. Among these were the Kansas City St. Patrick's Day Parade (where the transmitter was exposed to cold weather and the receive site was the cab of a garbage truck, using 12V battery power), a talk show in which the host roamed around the audience, and the aforementioned baseball game at spring training. In all of these cases, the system performed well.

The only complaints about the system are non-performance oriented. An instruction manual that includes service data would be useful, but it is not available, nor is a separate service manual. The instructions provided with the unit are aimed at those with limited experience with wireless systems and they do an adequate job of helping those people get the system on-line. The body-packs could also employ a more substantial case. Although this may not be necessary, it would give the user a more comfortable feeling when strapping the system on to some demolition derby driver.

The tests of the Nady 750 VHF wireless system showed that this product can serve broadcasters well. It has several convenient features that will make remotes more pleasant, and its performance is as good or better than comparable wireless systems. This is not the cheapest wireless microphone system you can buy, but it certainly provides good value. If you need wireless microphones for your remotes, seriously consider this system.

Editor's note: Field reports are an exclusive *BE* feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting company.

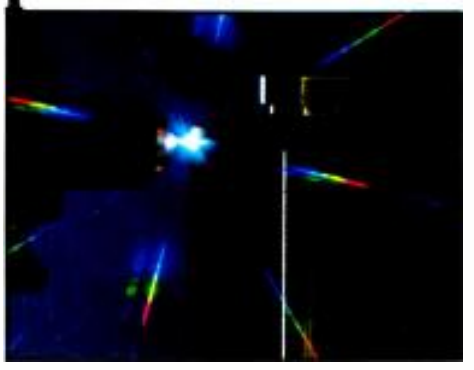
In essence, these reports are done by the industry and for the industry. Manufacturer's support is limited to providing loan equipment, and to aiding the author if requested.

It is the responsibility of *Broadcast Engineering* to publish the results of any device tested, positive or negative. No report should be considered an endorsement or disapproval by *Broadcast Engineering* magazine.

Editor's note: The Nady 750 receiver was tested in this report with the optionally available Nady HT-40 microphone, instead of the normally supplied HT-10 microphone.

➡ *For more information on the Nady 750 VHF wireless system, circle Reader Service Number 307.* ■

Applied Technology



NV5000: A universal sync generator

By Don Joy

Numerous problems may be encountered in production and post-production houses when using multistandard video and digital audio formats. One typical example occurs when transferring video between PAL and NTSC.

The NV5000 offers a workable solution to this difficulty by providing simultaneous outputs of PAL video and NTSC video, both locked to a common clock.

Incompatibilities

Digital videotape recorders (DVTRs) and analog VTRs that support digital audio typically use an internal digital audio sampling frequency of 48kHz. This internal rate is phase-locked to the video of the VTR, providing synchronization for the audio and video data. Although the internal digital audio is locked to the internal video when a PAL-to-NTSC (or vice versa) conversion is performed, the two VTRs are not actually locked together. The result can be dropped samples, which produce pops and clicks in the converted program audio. (See Figure 1.)

One workable solution

The recent development of a universal sync generator, NV5000, offers a workable solution to this difficulty by providing simultaneous outputs of PAL video and NTSC video, both locked to a common clock. The result is that the two video outputs and their internal digital audio signals are locked to a common reference. This eliminates the popping and clicking degradation in the audio program.

Joe is market development manager, nVision Inc., Nevada City, CA.

Different configurations of this solution are possible, depending on a facility's particular needs. One approach drives the universal sync generator with a 5MHz external atomic master timing reference. It also is possible to allow the unit to operate in the free run mode, serving as the master timing reference.

If the facility already operates with an NTSC or PAL video timing reference, the universal generator can lock to the existing external video reference as a common clock. In this case, because the NTSC or PAL reference generator already exists, only one output of the secondary video format (PAL or NTSC) is required. A potential drawback of this configuration is the more stringent timing specification for PAL than for NTSC. (See Table 1.) Producing a PAL video reference by locking to a master NTSC timing signal can create timing problems in the resultant PAL video program.

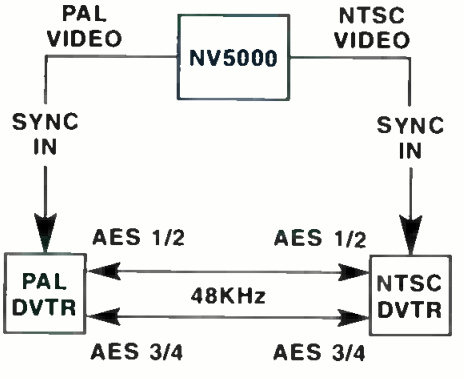


Figure 1. An application for click-free audio, using the universal sync generator.

Audio attributes

Many facilities use AES/EBU or SDIF-2 word clock sources at a variety of sampling frequencies to lock digital audio equipment together. Most professional applications specify 48kHz as the digital audio sampling frequencies. Consumer digital applications, such as compact discs, use 44.1kHz. A 44.056kHz rate is used for drop-frame video, where 44.1kHz digital audio is locked to video. In addition to providing reference frequencies, the universal sync generator generates AES/EBU test tones as well as the SDIF-2 word clock at these sampling rates to accommodate this requirement.

Digital audio test tones generated by the unit are accurate in terms of frequency and amplitude. Test tones can be used to ensure that the facility's response remains flat throughout the audio chain. AES/EBU alignment tones are available at each sampling frequency for gain adjustment purposes.

Video test generators can be locked to the universal generator, answering the need for a synchronous test source.

An alternative preferred in some instances is a source of digital silence. A digitally silent datastream contains all the timing and header information necessary for testing and adjustment, but without an audible tone. SDIF-2 word clock data is a square wave used for timing only. No test tones or audio signals are associated with the SDIF-2 word clock.

Another use for digital audio test tones or SDIF-2 data is to verify that the digital audio routers are functioning properly. Digital audio data that is being moved through a digital router must be mapped, which means a signal must be present with a source and a destination for routing. Audible tones at the router's destination offer easy verification of proper function of the switcher and other associated terminal equipment.

Video attributes

The universal sync generator concept also provides the option of generating PAL or NTSC color bars or blackburst. These signals contain timing information, equalizing pulses, horizontal sync and so on necessary for locking video signals together. Blackburst (or color black) is the equivalent of digital silence in the digital audio

domain; all timing information is present, but the video monitor displays black.

Color bars provide the operator with visual verification that video is present on the monitor. The color bars generated by the unit are not broadcast quality. They are strictly for visual convenience and video timing requirements. However, video test generators can be locked to the universal generator, answering the need for a synchronous test source.

PAL-B/-G/-H subcarrier = 4,433,618.75Hz ± 5Hz
PAL-B/-G/-H stability = 4,433,618.75Hz ± 1.1277ppm
PAL-I subcarrier = 4,433,618.75Hz ±1Hz
PAL-I stability = 4,433,618.75Hz ±0.225ppm
NTSC-M subcarrier = 3,579,545Hz ±10Hz
NTSC-M stability = 3,579,545Hz ±2.79ppm

Table 1. A comparison of PAL variants and NTSC subcarrier and stability tolerances.

A universal sync generator can cost-effectively resolve these problems by functioning as a common reference to which all equipment is linked.

Some options

A facility can synchronize digital audio and video in several ways. First, individual pieces of equipment can provide the necessary functions. For example, a system containing an SDIF-2/AES sync source, a PAL sync generator and an NTSC sync generator will satisfy many needs. For a facility that does not require the dual video standard, simply delete the particular generator that is not used.

Although such a grouping will meet most requirements, the separate NTSC and PAL sync sources would not be locked together. The addition of a universal sync generator could be added to provide the dual-format locking function.

For a simplified future

As the distance between the continents diminishes through the use of communications systems, the problems by different audio and video standards become evident when transferring material. Many problems encountered in facilities with multistandard video and digital audio sources result from differences in the timing of these standards. A universal sync generator can cost-effectively resolve these problems by functioning as a common reference to which all equipment is linked.

➡ *For more information on the nVision NV5000 sync generator, circle Reader Service Number 309.* ■

Continued from page 38

are established to flatten frequency response, and compensate for level and delay differentials among the lines. Most current devices handle this automatically. Some systems further simplify the process by including memory, auto-dial and auto-answer features.

Amortization of these devices can be calculated against the often high-priced alternative of 5kHz or 8kHz telco program circuits (where they are still available).

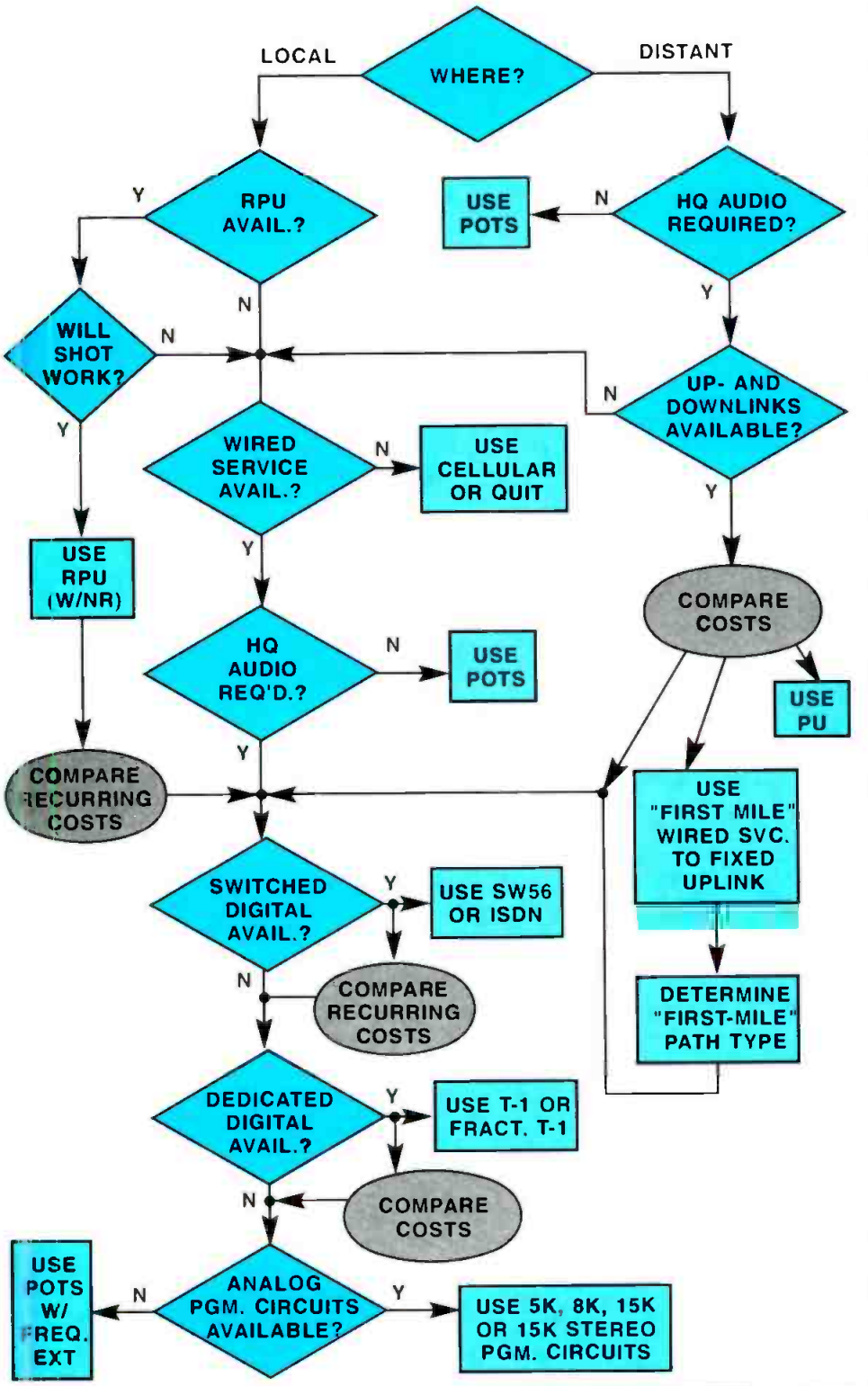


Figure 1. *Flowchart for transmission medium decisions in remote backhaul.*

For stations with a microwave RPU, there are often remote locations from which the RF signal gets through, but the resulting audio is extremely noisy. Although future digital RPU systems may eventually help in these cases, the addition of a simple complementary noise-reduction system today can help an existing analog RPU sound much better with minimal expense.

For high-quality music or other remotes, wideband stereo backhaul traditionally is done on satellite for long distance and via dedicated, stereo-conditioned 15kHz analog telco lines or dual RPU for local feeds. Complementary noise reduction can help on these systems as well. Some stations use video telco circuits (or a video RPU) with the pseudovideo PCM processors that were popular in the 1980s. In most cases, these systems still provide excellent (although wideband and expensive) service.

On-site production

The level and complexity of production required by radio remotes extends across a tremendous range of possibilities, from a single mic, pre-amp and phone-line driver, to an 18-wheeler filled with multichannel consoles, racks of digital processing and a portable uplink.

Key words in a live remote set up are *reliability* and *simplicity*. But as Einstein said, "A system should be as simple as possible, and no simpler." A certain level of complexity is required to cover all the possibilities at these events. Thus, reliability of this equipment and operator familiarity with its operation are important.

Promotional-type remotes are usually the simplest, with station talent using headset and/or hand-held microphones to announce from the scene and interview people on location. The trickiest part on the production end is often the talent's (and the audience's) monitoring feed. Keeping the station's air signal on the venue's sound system during the remote is usually desirable. But a way must exist for the station's remote crew to attenuate it or shut it off during the actual announcer breaks from the site, thus preventing feedback on the air.

Sports or news remotes are the next level of complexity. Usually, multiple announcer mics plus other mics capture the natural sound of the event. Often, a PA feed also must be accommodated, and some playback devices are typically at the site as well. In some cases, one or more roving reporters with wireless mics may be included, or telephone interfaces for call-in elements may be required. Nevertheless, one operator can usually handle the whole show. In some cases, automatic mic mixers can help. New generations of the latter have made them more friendly to broadcast applications than

Continued on page 85

Industry Briefs

BUSINESS SCENE

Continental Electronics Corporation (CEC), Dallas, has received a multimillion dollar contract from the Ministry of Information of the State of Kuwait through the Sayed Hamid Behbehani and Sons Company, Kuwait. The contract calls for the manufacturing and installation of two type 320-H 600kW medium-wave transmitters and antenna equipment.

Belar Electronics Laboratory, Devon, PA, has sold 17 AMMA-1 "The Wizard" AM modulation analyzers to the Voice of America for use at its installations in Morocco and Thailand.

Dynair, San Diego, CA, has installed the first DYNA-Mux fiber-optic audio/video transmission system at the North Slope Borough School District in Barrow, AK.

Otari, Foster City, CA, has installed a ProDisk-464 hard drive recording and editing system at Skywalker South Sound.

Andrew Corporation, Orland Park, IL, has designed a high-band VHF panel antenna for KABC-TV, Los Angeles. In addition, Andrew will install a side-mounted Channel 53 UHF TRASAR directional antenna at the FCC Advanced Television Advisory Committee facility in Charlotte, NC. It will be used for supplementary field tests.

Solid State Logic (SSL), Oxford, England, has sold Scenaria audio/video post-production systems to Producer's Color Service, Detroit; Avenue Edit, Chicago; and Video Post & Transfer, Dallas. New York-based Post Perfect also has purchased three Scenaria systems.

In addition, SSL has sold a ScreenSound system and a SoundNet system to Fox Broadcasting.

Orban, San Leandro, CA, has shipped its 500th digital 8200-FM Optimod.

Odetics, Anaheim, CA, has installed a TCS90 cart machine and an external machine controller and traffic interface at the Air Force Broadcast Services facility in Lajes Field, Azores Islands.

Snell & Wilcox's (Hampshire, England) HD3100 high-definition cross-converter was used to convert footage of the annual Montreux Jazz Festival from HDTV to PAL.

Sony, Park Ridge, NJ, has been awarded a contract by Hughes Communications Inc. (HCI), Los Angeles, to design and install the direct broadcast satellite plant for its network, DirecTv. Set to launch in early 1994, DirecTv will offer pay-per-view movies, live events and entertainment programming to subscribers throughout the continental United States.

In addition, Tribune Broadcasting's Chicagoland Television News has contracted with Sony to provide video systems for its new turnkey TV facility.

Asaca Shibasoku Monitors (ASA), Los Angeles, has received orders for its 205 series 900+ TVL high-resolution auto setup monitor. Consumer Reports, New York, purchased five of the monitors, and C&C Video Production, New York, purchased one.

Dynatech Video Group, Madison, WI, has made a substantial sale of post-production equipment to three Editel facilities based in New York, Los Angeles and Chicago.

TFT, Santa Clara, CA, and **Gentner**, Salt Lake City, have formed a marketing partnership that will allow the companies to participate in certain marketing ventures, including sales and training seminars, trade show displays and special sales packages.

ITS, McMurray, PA, has added 10,700 square feet to its existing facility.

NVision, Nevada City, CA, has established a regional sales office in Sherman Oaks, CA.

Magni Systems, Portland, OR, has won the Editor's Choice Award from PC Magazine for its VGA Producer Pro.

Panasonic, Secaucus, NJ, has named National TeleConsultants, Glendale, CA, and A.F. Associates, Northvale, NJ, as systems integrators for its D-3 1/2-inch digital product line.

Thomson Broadcast, Englewood, NJ, won a technical Emmy Award in the category of Motion Vector Compensated Standards Conversion for its TTV 7810 standards converter. The converter was first used by CBS and NBC in their broadcasts of the 1992 Winter and Summer Olympics.

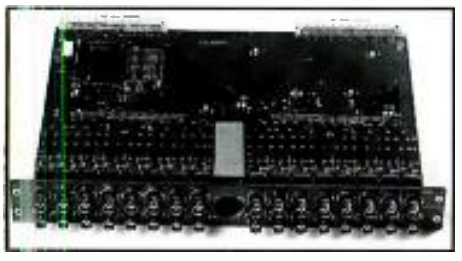
Vistek, Los Gatos, CA, was awarded an Emmy for Outstanding Technical Achievement for Motion Vector Compensated Standards Conversion. ■

New Products

Video delay amp
By Lenco Electronics
• **PVD-154:** a modular video delay DA with a 32MHz bandwidth and a total delay range of 475ns; optional plug-in delay block increases the delay range in increments of 200ns, 300ns, 400ns or 500ns, up to a total of 975ns; operates in the PFM-100, PFM-300 or PFM-600 mounting frame; contains six outputs; nine DAs can operate in one mounting frame.

Circle (351) on Reply Card

Serial digital routers
By Leitch
• **Video serial router modules:** a series of 143Mbs to 270Mbs serial digital router modules for the HEDCO X^{plus} router series; compact modules operate in D-1, D-2 and D-3 for NTSC and PAL; all modules include equalization and reclocking; 16×16, 8×16 and 8×8 matrices can be standards-independent; 8×8 matrix offers dual outputs.



Circle (352) on Reply Card

Still File
By Leitch
• **Combo:** combines features of NTSC/D-2 Still File and D-1 Still File Gateway; two users with different video standards can operate at the same time, without the need for external video transcoders or converters and without affecting each other's operation; allows up to four composite video channels each with NTSC and D-2 interface; component suites can have up to four 4:2:2 or two 4:2:2:4 channels; can be networked to any other Still Files and to Database Workstation by adding the Still Net option.

Circle (353) on Reply Card

Studio lenses
By Fujinon
• **Ss18 X 6ESM:** 18× zoom ratio; 6mm to 108mm focal length (12mm to 216mm with built-in 2× extender); maximum aperture ratio of f/1.4 over the entire focal length range; 0.58m minimum object distance.
• **As18 X 8ESM:** 18× zoom ratio; 8mm to 144mm focal length range (16mm to 288mm with built-in 2× extender); maximum aperture ratio of f/1.5 from 8mm to 114mm and f/1.9 to 144mm; 0.58m minimum object distance.

Circle (356) on Reply Card

Digital decoder
By Yamashita Engineering Manufacture
• **EDEC-2000:** digital decoder and line doubler enhances and improves NTSC video output; reduces noise; minimizes smearing and eliminates distracting artifacts, such as visual scan lines, cross-color and dot and chroma crawl; includes a 3-D digital comb filter; ideal for boardroom projections or large screen presentations.

Circle (354) on Reply Card

Digital interface
By Leitch
• **Targa:** Still File interface supports 3100WS Database Workstation package; based on software that allows standard MS-DOS computers to connect to any Still File via the Still Net ethernet network; allows studio personnel to search for stills on any or all Still File systems, edit still descriptions and display them in full color on the computer monitor; Database Workstation can convert DOS Targa image files created by a variety of paint systems; Macintosh and other computer systems can be connected through the use of off-the-shelf third-party networks.

Circle (355) on Reply Card

Professional camcorder
By BTS
• **LDK-491SR:** CCD camcorder offers new FT-5SR series CCD sensors; provides smear-free pictures, including high-contrast night shooting and a high signal-to-noise ratio; weighs 15 pounds with lens, 11 pounds without lens; includes a precision high-resolution, high-brightness 1.5-inch viewfinder; 4-position filter wheel adjusts to all lighting conditions; Betacam-SP recorder uses 1/2-inch metal or oxide videotape.

Circle (357) on Reply Card

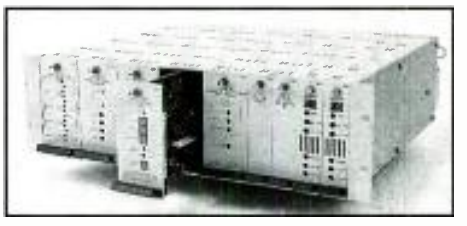
Telephone interface
By Pesa
• **PVC5000:** controls Pesa routing matrices; permits full control of the routing system from any standard touch-tone telephone; FCC approved; provides 4-level router control up to 256 outputs; mimics the operation of the Pesa Universal Model 1 X–Y control panel; includes a non-volatile memory for configuration data storage.

Circle (358) on Reply Card

Video multimeter
By Plateau Digital
• **PVM-1073 NTSC:** locates, averages and displays video measurement data in a concise format by using a 12-bit A-to-D converter with digital signal processing; display update rates allow real time signal adjustment; numeric results permit onboard and remote computer manipulation; measurements include vectorscope chroma gain, phase, differential; waveform monitor timing, levels, response; picture viewer signal ID; multiformat wideband peak-to-peak; noise (signal and hum); and vertical interval.

Circle (359) on Reply Card

D-to-A converter
By Grass Valley Group
• **M9211-N:** includes auto-timing capability; double-width MAX module converts serial composite NTSC digital signals to analog; 10-bit resolution; reference input accepts black color; automatically adjusts the timing of the output signal to match reference signal; 33ms auto-correction window; manually adjustable output timing relative to the reference signal.



Circle (367) on Reply Card

Still-store unit
By FOR.A
• **VPS-510SU:** features an optional plug-in D-RAM frame memory for the VPS-510 series video production system, which allows instant storage and access from the control panel of up to 16 still images; stores eight frames and 16 field still images; stored images can be recalled on A and B bus.

Circle (363) on Reply Card

Digital cart decks
By Digital Broadcast Associates
• **db-Cart:** uses 21Mb Floptical disk drive; drive uses 3 1/2-inch 21Mb Flopticals diskettes and 1.44Mb diskettes; can be bulk erased and reformatted in the field; 4:1 compression rate; coding delay of less than 4ms.

Circle (368) on Reply Card

Documentation package

By Systems Engineering Solutions

• **Post-production and mobile SNG documentation:** for integration and operation of all systems using state-of-the-art writing and CAD illustration software; produces operation and maintenance instructions to include floor plans, equipment elevations, illustrated parts lists, wiring diagrams and modification notices to customer requirements.

Circle (364) on Reply Card

PC cards

By ESE

• **PC Family:** consists of four PC cards, including the PC-219 (five output, blackburst generator), PC-207A (1×4 video distribution amp), PC-217 (1×4 audio DA) and the PC-237 (1×4 wideband 120MHz video DA); each board is a half-card size designed to plug into any computer with PC-compatible expansion slots (IBM and Amiga); PC-219 provides an RS-170A blackburst signal for preblacking tapes and/or for general synchronization purposes; PC-207A, PC-217 and PC-237 distribute audio or video signals to more than one source or along lengthy cable runs without any signal loss.

Circle (365) on Reply Card

Production switcher

By Grass Valley Group

• **Model 4000:** a component digital production switcher; features full 10-bit processing; incorporates exclusive "key follow video" architecture; model 4000-2B has 16 inputs; model 4000-2A has 24 inputs, and wipes in the program/preset mixer; both models have two M/Es, a program/preset mixer and a downstream keyer; all model 4000 systems include switch-selectable 525/625 line operation.

Circle (385) on Reply Card

Digital video switcher

By Panasonic

• **AS-D700:** a composite digital switcher that uses standard serial digital I/O; 4-bus multilevel single M/E system provides 15 video inputs, color black and 2-color backgrounds; 4-bus configuration offers preset, program and external key and key fill levels; optional parallel digital and analog I/O boards allow a total of 27 auto-timed inputs; inputs can be assigned to any crosspoint; 3-channel auxiliary bus available for routing sources to a digital effects device.

Circle (373) on Reply Card

Test signal generator

By Multidyne

• **TS12-RM:** offers up to 12 NTSC test signals, including SMPTE color bars, FCC multiburst, multipulse, 5MHz line sweep and NTC-7 composite and combination; character generator produces 16 battery-backed messages of 32 characters each; balanced stereo audio generator provides three frequencies of tone with a right channel ID and a lip-sync audio and video synchronizing signal; rack-mounted; includes loop-through of external video and stereo audio; automatic bypass upon the

loss of external video and insertion of a 16-character vertical interval ID into external video.

Circle (360) on Reply Card

Battery connector

By Frezzolini Electronics

• **NP1:** for use with Mini-Fill light; eliminates need for different camera and light batteries; saves cost of purchasing additional adapters; optional lightweight pouch holds two NP1-type batteries; Mini-Fill model MF-NP1 comes standard with 50W lamp and a 4-foot line cord terminated in an NP-1 battery connector.

Circle (361) on Reply Card

Chargers

By Frezzolini Electronics

• **AR series:** four auto-ranging computer-controlled chargers comprised of two single-channel (AR121 and AR301) and two 4-channel (AR124 and AR304) models; will fast-charge NiCad batteries within ranges 4.8V to 14.4V, 1Ah to 7Ah capacity and 12V to 30V, 2Ah to 10Ah capacity; 4-channel models sequentially charge up to four batteries of mixed voltages and capacities within their ranges; all chargers incorporate the latest high-frequency switch-mode power supply design; operate using advanced charging system (ACS).

Circle (362) on Reply Card

Routing switchers

By Sierra Video Systems

• **Model 32V:** video switcher can be stacked to provide multibus capabilities; built-in RS-232 serial interface; includes MS-DOS-compatible control software; designed to be used with model 32S.

• **Model 32S:** stereo audio router; ideal for switching applications that require a large number of inputs; can be used alone or slaved to the 32V for AFV operation.

Circle (370) on Reply Card

Hardware/software updates

By Sony

• **BVE-910 update:** audio special update provides direct video editor compatibility with audio mixers supporting ESAM-II serial protocol; users now have advanced control of Sony DAT machines, including activation of the PCM-7030/7050 memory start capability.

• **BVE-9000/9100:** software provides new B-mode and C-mode sort and other event list management functions; alphanumeric reel numbers are fully supported; interface allows the editor to control the Sony Flexicart system.

Circle (366) on Reply Card

S-VHS recorder

By JVC

• **BR-S422U:** a compact dockable S-VHS recorder; weighs less than seven pounds; offers reduced power consumption, quick-response recording start, optional plug-in time-code generator, built-in AEQ, and 4-channel audio with two linear channels and two hi-fi channels; incorporates S-VHS technology with resolution of more than 400 lines; uses full-size S-VHS tapes that provide up to two hours of recording per tape.

Circle (375) on Reply Card

Demodulator

By Videotek

• **DM-141A:** replaces DM-141S; can tune in up to 154 channels; channels tuned are: 2-13 (which are the same for the cable and antenna modes), 14-69 UHF in the antenna mode and 14-99 in the cable mode; cable channels are 14-22 in the midband, 23-94 in the superband and 95-99 in the 88MHz to 120MHz range; fine tuning of ±4MHz in 63kHz steps can be adjusted from the front panel; in case of a power outage, 1-week memory stores channel selection, fine tuning status of each channel, audio volume, etc.

Circle (379) on Reply Card

ENG/EFP lenses

By Canon

• **YJ17x9.5B KRS:** a broadcast-quality lens for 2/3-inch CCD cameras; 17:1 zoom ratio; 0.95m minimum object distance; 9.5mm to 162mm focal length; weighs 3.2 pounds.

• **YH17x7B KRS:** a broadcast-quality lens for 1/2-inch CCD cameras; same zoom ratio and minimum object distance as YJ17x9.5B KRS lens; 7mm to 119mm focal length; weighs 3.2 pounds.

Circle (383) on Reply Card

Switching control system

By Ramko

• **ICS-1 and ICS-1A:** allow user to configure countless audio and data systems, such as auto-room combiners, programmable zone paging and background music, computerized audio control for simulators, programmable intercom system and paging control, language labs and listening centers, and broadcast automation.

Circle (380) on Reply Card

Telephoto lens

By Canon

• **PJ40X 25B IE:** focal length range of 25mm to 1,000mm (50mm to 2,000mm with 2× extender); 40:1 internal function zoom ratio; 5m minimum object distance; weighs 22kg.

Circle (384) on Reply Card

DSP camera

By Panasonic

• **WV-F500:** uses three 380,000 1/2-inch superhigh sensitivity IT CCDs; achieves 700 lines of horizontal resolution; signal-to-noise ratio greater than 62dB typical; high sensitivity of f/8 at 2,000lux; docks with AU-45H EnHanced Series MII dockable VTR and the AG-7450 S-VHS dockable VTR.

Circle (372) on Reply Card

Software

By Abekas

• **Version 4.5:** software for the A72 digital character generator; features include light shading, splined animations and enhancements to the ramp shading feature; tension function allows user to create nonlinear animations; ease function similar to time smoothing.

Circle (377) on Reply Card ■

Continued from page 79

earlier designs, which were primarily intended for sound reinforcement.

In the sports/news remote, monitoring feeds also are critical. The mix engineer on-site must have a way of hearing communication commands and cues from the station in his/her headphones along with the program mix. Furthermore, the engineer should be able to talk back to the station on the separate communications line. If a director, statistician or other support person needs to talk to the talent during the show, the monitoring system must be able to accommodate this easily. In the engineer's and the talents' cases, this off-air audio can be kept distinct from the on-air program in headphones by placing the "com" signal in one ear only, while the on-air show is in both ears (stereo or mono). This is a common feature available on many of today's interruptible foldback systems (IFBs).

In today's increasingly competitive environment, radio stations are well served by playing their strongest hand, and live remote origination of programming is certainly something radio does best.

The highest level of complexity is encountered in live music remotes. These events often employ two or more separate mixing consoles in different places to divide various functions for optimal results in each area. An extreme case includes four separate mixing positions: 1) house PA mixing for the on-site audience; 2) stage monitor mixing for performers; 3) music mix for air; 4) broadcast program mix. Console No. 4 takes the music mix from No. 3 and adds all the broadcast continuity, such as vocal host/talent and recorded themes, features, spots and the like. Separating the functions of consoles No. 3 and No. 4 is especially helpful when the program includes multiple acts and requires a stage changeover during the broadcast. This division of duties allows console No. 3 to repatch and soundcheck with impunity during the changeover, while console No. 4 holds forth by itself on the air. Once the next act is ready, console No. 4 brings the music mix from console No. 3 back up on its faders to air.

Such an arrangement also allows the operator of console No. 4 to worry about standard broadcast issues, such as the backhaul and monitoring paths, while the console No. 3 operator can concentrate on the aesthetic issues of the music mix. Finally, it allows the two consoles to be optimally chosen for their specific and widely disparate duties.

Where to?

The future will probably see increased use of digital backhaul, as well as increased digital audio production hardware on-site. Trends toward simpler, smaller and cheaper equipment are welcome, and many of these bring along increased audio quality and flexibility in the bargain. This makes the remote operation more efficient and easier, allowing more wide-ranging locations and more imaginative programming to be accommodated. Remotes will continue to be an area of specialty for the radio medium, one which the savvy broadcaster will exploit to its fullest.

➡ *For more information on radio remote equipment, circle Reader Service Number 301.* ■

Professional Services

Classified

SERVICES

TRANSMITTER TUBE REBUILDING SINCE 1941: 3CX2500, 4CX5000, 4CX15000 and many others. Write for details. FREELAND PRODUCTS INC., 75412 Hwy. 25, Covington, LA 70433. (504) 893-1243 or (800) 624-7626.

FOR SALE

Circle (57) on Reply Card

1982 VOLVO F-611 DIESEL TRUCK, tilt cab. Used by Wold as a C-Bank Uplink Truck. Recent engine overhaul. 15 MPG. Diesel generator 45KW. $40,000.00. 702-877-5990.

ADVANCED SCA DEMOD CARDS — Built on demand by an experienced SCA engineer. Seven frequencies available. $19.95. Volume discounts available. SCS Radio Technology - 417-881-8401

GRASS VALLEY KALEIDOSCOPE DPM-1 $79,000.00 CONTACT DIANE STAFFORD GREENE, CROWE & COMPANY (818) 841-7821

MISC. POST PRODUCTION EQUIPMENT: G-P 612 AUDIO, Calaway c2's, GVG-NEC DVE's, E-Flex, and much more. Call or Fax for equipment list. Contact Bob Blanks at 213-463-7064/Fax 213-461-2561

BROADCAST PRODUCTS INC. AR-1000/2000 automation system. This system was taken off the air in good working condition and includes all elements necessary for fully automated station. Please call (216) 993-2126 and ask for Brian Wolf.

Classified

HELP WANTED

HELP WANTED

EQUIPMENT WANTED

WANTED: USED VIDEO EQUIPMENT. Systems or components. **PRO VIDEO & FILM EQUIPMENT GROUP:** the largest USED equipment dealer in the U.S.A. (214) 869-0011.

WANT TO BUY used 100 watt solid state translator transmitter, in good condition. VHF in, UHF out. Call Mike Lee, 806-383-2226 or Fax 806-381-9859.

HELP WANTED

PRODUCT MANAGER—TEST EQUIPMENT. Neutrik USA, a leading manufacturer of Audio Test Equipment, is looking for a qualified candidate as Product Manager for its growing family of products. The candidate should have the following qualifications: A B.S.E.E. or associates degree in electrical engineering, and/or 4 years of experience with Acoustic fundamentals. At least three years as a product manager or specialist in products relating to test and measurement or related audio fields. Position will be responsible for creating operating and training manuals, performing product demonstrations, training and customer support. Travel within Representative territories, as well as generating collateral marketing materials. The successful candidate must possess excellent verbal and written communication skills. The ability to help troubleshoot customer application problems is required. Neutrik USA offers a challenging work environment for a self-starting, highly-motivated individual. Please submit Resume and salary requirements to: Personnel Department, Neutrik USA, Inc., 195 Lehigh Ave., Lakewood, New Jersey, 08701-4527. We are an Equal Opportunity Employer. Principals only, please!

TRAINING

FCC GENERAL CLASS LICENSE. Cassette recorded lessons with seminars in Washington, Newark, Philadelphia. Bob Johnson Telecommunications. Phone (213) 379-4461.

Ad Index

	Page Number	Reader Service Number	Advertiser Hotline
Abekas Video Systems	*19	13	415-369-5111
Acrodyne Industries, Inc.	31	20	800-523-2596
Ampex (AVSD)	40-41	27	415-367-2011
Ampex Recording Media	9	8	415-367-3809
Antex Electronics	76	48	213-532-3092
Audio Precision	13	10	800-231-7350
Aydin West	15	11	408-629-0100
Belar Electronics Laboratory	76	47	215-687-5550
Bird Electronics Corp.	46	31	216-248-1200
Broadcast Video Systems Ltd.	73	46	416-764-1584
Carver	78	49	800-443-CAVR
Cellcast	IBC	2	918-272-8504
Clark Wire & Cable	74	51	708-272-9889
Clear-Com Intercom Systems	85	54	510-527-6666
Conex Electro Systems	73	45	206-734-4323
Denon	43	28	201-575-7810
DPS	80	50	606-371-5533
Dolby Labs, Inc.	50-51	34	415-558-0200
Dynatech Corporation	11	9	608-273-5828
Electro-Voice	28	17	616-695-6831
Enco Systems, Inc.	55	35	800-ENCO-SYS
Harris Allied Systems	1	4	800-622-0022
illbruck	73	44	800-662-0032
Jampro Antennas, Inc.	30	19	916-383-1177
JVC Professional Products Co.	61	37	800-JVC-5825
Lamp Technology	87	58	516-567-1800
Leader Instruments Corp.	27	15,16	800-645-5104
Lectrosonics	67	40	800-821-1121
Leitch, Inc.	BC,33	3,22	800-231-9673
Logitek	69	41	713-782-4592
Maxell Corp of America	37	25	800-533-2836
Midwest Audio	86	57	708-251-0001
NAB Broadcasters	57	36	202-429-5350
Neutrik U.S.A	59	56	908-901-9488
Nikon Electronic Imaging	5	6	800-NIKONUS
OMB Sistemas Electronicos	*19	14	347-627-4537
Opamp Labs, Inc.	73	55	213-934-3566
Orban, Div of AKG Acoustics	7	7	510-351-3500
Otari Corp.	62-63	38	415-341-5900
Panasonic Broadcast & TV	34-35		800-524-0864
Pesa Switching Systems	IFC	1	205-880-0795
Pioneer RVR Division	45	30	202-527-6400
Quantel	49	33	203-656-3100
Radiation Systems	44	29	708-298-9420
Sanix Corporation	65	39	708-677-3000
Shure Brothers, Inc.	82-83	52	800-25-SHURE
Solid State Logic Ltd.	29	18	800-343-0101
Sony Business	24-25		800-635-SONY
Sony Recording Media	52-53		201-930-7081
Switchcraft, Inc./Div. Raytheon	39	26	312-792-2700
Tascam	21	23	213-726-0303
Telex Communications, Inc.	3,70-71	5,43	612-887-5530
United Ad Label Co., Inc.	46	32	800-423-4643
Vega, A Mark IV Company	38	24	818-442-0782
Videotek, Inc.	47		800-800-5719
Wavephore, Inc.	84	53	602-438-8700
The Winsted Corporation	69	42	800-447-2257
360 Systems	17,32	12,21	818-342-3127

*Denotes demographic coverage

Advertising sales offices

NEW YORK, NEW YORK
Gordon & Associates
210 President Street, Brooklyn, NY 11231
Telephone: (718) 802-0488
FAX: (718) 522-4751
Joanne Melton
Telephone: (212) 332-0628
FAX: (212) 332-0663
888 7th Avenue, 38th Floor
New York, NY 10106

CHICAGO, ILLINOIS
Vytas Urbonas
Telephone: (312) 435-2361
FAX: (312) 922-1408
55 East Jackson, Suite 1100
Chicago, IL 60604

SANTA MONICA, CALIFORNIA
Herbert A. Schiff, Telephone: (310) 393-9285
Jason Perlman, Telephone: (310) 458-9987
Schiff & Associates
501 Santa Monica Blvd, Ste. 401
Santa Monica, CA 90401
FAX: (310) 393-2381

OXFORD, ENGLAND
Richard Woolley
Intertec Publishing Corp.
Unit 3, Farm Business Centre,
Clifton Road, Deddington,
Oxford OX15 4TP England
Telephone: (0869) 38794
FAX: (0869) 38040, Telex: 837469 BES G

TOKYO, JAPAN
Mashy Yoshikawa
Orient Echo, Inc., 1101 Grand Maison
Shimomiyabi-Cho 2-18
Shinjuku-ku, Tokyo 162, Japan
Telephone: (03) 235-5961,
FAX: (03) 235-5852,
Telex: J-33376 MYORIENT

FREWVILLE, SOUTH AUSTRALIA
John Williamson
Hastwell, Williamson, Rep. Pty. Ltd.
109 Conyngham Street
Frewville 5063, South Australia
Phone: 799-522, FAX: 08 79 9522
Telex: AA87113 HANDM

CLASSIFIED ADVERTISING
OVERLAND PARK, KANSAS
Renee Hambleton, P.O. Box 12901,
Overland Park, KS 66282, 913-967-1732

REMOTE BROADCAST STUDIO

Cellcast®

Anytime, Anywhere.

Remote Possibilities Become Reality.

Cellcast® is the *cellular* difference. More efficient than your old portable, more cost-effective than a van full of expensive equipment.

Remote Ready. Everything you need to broadcast – including a frequency extender and mixer – in a compact and easy-to-carry unit.

Sound Solutions. Cellcast® broadcasts crisp and clear. It's as close to studio quality as you can get with state-of-the-art cellular phone technology.

On-Air On-Time. Cellcast® offers a transmission option of cellular or land-line remote broadcasting. So no matter what the situation calls for, you've got what you need to be on-site and on-air within seconds.

Superior Support. Cellcast® quality is backed by service you can count on. In addition to the standard 1-year warranty on every unit, we provide a 24-hour, 7-day a week product support. A replacement unit will be sent to you OVERNIGHT if your unit fails to operate... All of this for the low price of $2950.00, FOB, Owasso, Oklahoma.

2-Week Trial! Call 1-800-852-1333 and ask for Bridget Taylor to try a Cellcast® RBS 400 for two weeks. For $195.00, Cellcast® provides a unit ready to be activated by your local cellular service. Cellcast® will deduct the trial charges from your purchase.

Remote possibilities have become reality. Anytime, anywhere. With Cellcast®.

Lease Purchase Terms Available
Call 1-800-852-1333 today!

Cellcast®
REMOTE BROADCAST STUDIO

110 So. Main, Owasso, OK 74055

Circle (2) on Reply Card

Pick A Card...

A CARD LIKE OUR UTILITY VIDEO DA.

We've put it in our economical MIX BOX to give you the best value per output offered in a self-powered DA, with looping inputs and 8 outputs of broadcast video.

Excellent VALUE highlights all MIX BOX DAs. These same LEITCH 8 OUTPUT DAs populate our 19" rack-mount frames and exceed all broadcast industry standards.

Video DAs include utility video distribution, equalization, clipping, delay, and clamping.

Audio DAs have balanced high impedance inputs and a choice of 8 mono or 4 stereo balanced outputs.

Don't gamble with Quality over Economy; Get both...

LEITCH DAs STAND ALONE

in a self-powered MIX BOX!

PICK A LEITCH DA CARD IN A MIX BOX.

LEITCH

FOR IMMEDIATE RESPONSE, FAX THIS PAGE TO (804) 548-4210.
To receive information by mail, call (800) 231-9673.

NAME _____ *FAX NUMBER* _____

Leitch Incorporated. 920 Corporate Lane. Chesapeake. VA 23320 - Tel: (804) 548-2300 or (800) 231-9673 Fax: (804) 548-4088
Leitch Video International Inc.. 220 Duncan Mill Road. Suite 301. Don Mills. Ontario. Canada M3B 3J5 - Tel: (416) 445-9640 or (800) 387-0233 Fax: (416) 445-0595
Leitch Europe Limited. 24 Campbell Court. Bramley. Basingstoke. Hants. U.K. RG26 5EG - Tel: +44 (0) 880088 Fax: +44 (0) 256 880428

Circle (3) on Reply Card